Engineering Library

DEC 1 1930


# The Engineer.

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## The Engineer

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### PUBLIC NOTICES

**Crown Agents for the Colonies.**
COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/2522.—ASSISTANT BRIDGE ENGINEERS (2) REQUIRED by the GOVERNMENT of NORTHERN RHODESIA for a tour of 29 to 30 months' service and possible extension. Salary £480, rising to £600 a year by annual increments of £20. (The question will be considered of paying a higher commencing salary than £480 a year in the foregoing scale to a highly qualified candidate.) Free quarters and passages and liberal leave on full salary. Candidates, 28 to 35 years of age, preferably single, must have passed Sections A and B of the examinations to qualify for the A.M.I.C.E. Diploma or hold professional qualifications recognised by the Institution as exempting from those examinations. Must have had experience in the erection of large Steel and Concrete Bridges.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience and mentioning this paper, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/2522. 6195

**The High Commissioner** for India invites APPLICATIONS for ONE APPOINTMENT in the MECHANICAL ENGINEERING DEPARTMENT and ONE APPOINTMENT in the TRANSPORTATION (POWER) DEPARTMENT of INDIAN STATE RAILWAYS. Qualifications: Candidates must be British subjects and statutory natives of India. They must produce evidence that they have either (1) passed the qualifying examination for the Associate Membership of the Institution of Civil Engineers, the Institution of Mechanical Engineers or the Institution of Engineers (India), or (2) have obtained an Engineering Degree or Diploma recognised as granting exemption from such qualifying examination.

CANDIDATES APPLYING FOR APPOINTMENT TO THE MECHANICAL ENGINEERING DEPARTMENT must have served at least four years' apprenticeship or pupilage in a large Railway Locomotive Workshop, or with a firm of Locomotive Builders of repute. They should also have had at least one year's Drawing-office experience.

CANDIDATES FOR APPOINTMENT TO THE TRANSPORTATION (POWER) DEPARTMENT must have served in a Mechanical Engineering Workshop dealing with the Repair and Manufacture of Railway Locomotives and have had experience in Running Sheds and Firing.

NOTE.—Candidates who are theoretically qualified but who do not possess the Workshop or Practical experience specified will be considered for appointment in the first place as probationers under training for one year on a pay of Rs. 300 a calendar month.

TERMS.—Probation for three years, whereafter, if found qualified in all respects, retention on regular establishment. Commencing pay will be fixed according to qualifications in scale Rs. 375 a calendar month, rising by annual increments of Rs. 50 to Rs. 975 a calendar month. First-class passage to India. Provident Fund. Strict medical examination.

Further particulars and forms of application may be obtained upon request by postcard from the HIGH COMMISSIONER FOR INDIA, General Department, India House, Aldwych, London, W.C. 2. Last date for the receipt of applications, 20th December, 1930. 6162

**University of London.**

A COURSE of FOUR LECTURES on "SUPPORTS FOR UNDERGROUND WORKINGS IN COAL MINES" will be given by Dr. M. A. HOGAN, D.Sc., Ph.D., A.M. Inst. C.E. (of the Safety in Mines Research Board), at the IMPERIAL COLLEGE, ROYAL SCHOOL OF MINES, Prince Consort-road, South Kensington, on DECEMBER 8th, 9th, 10th and 11th, at 5.30 p.m. At the first lecture the chair will be taken by Sir Henry Walker, H.M. Chief Inspector of Mines.

ADMISSION FREE, WITHOUT TICKET.

S. J. WORSLEY,
6032 Academic Registrar.

**City of Oxford Education** COMMITTEE.
CITY TECHNICAL SCHOOL AND MUNICIPAL SECONDARY SCHOOL.

WANTED for January next, a GRADUATE in ENGINEERING, to Take Charge of the Engineering Department in the Technical School and Assist with Middle Form Mathematics in the Municipal Secondary School. Burnham Scale.

Applications, supported by testimonials, should reach the Principal not later than 8th December.

A. C. CAMERON,
Secretary for Education.

Education Office,
City Chambers, Oxford,
26th December, 1930. 6148

**Administrative County of** LONDON.

The London County Council invites TENDERS for the SUPPLY, DELIVERY and ERECTION of ONE SIX-ROLLER IRONING MACHINE at Leavesden Mental Hospital, Abbots Langley, near Watford, Herts.

The specification, form of Tender, &c., may be obtained on application to the Chief Engineer, Old County Hall, Spring-gardens, S.W. 1, upon payment of £1 by cheque, draft or Money Order to the order of the London County Council.

This amount will be returnable only if the tenderer shall have sent in a bona fide Tender, and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee.

Remittances, by post, should be addressed to the Chief Engineer, Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 2, No. 3 Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E.1, after 4 p.m. on Friday, the 19th December, 1930, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX,
6165 Clerk of the London County Council.

### PUBLIC NOTICES

**County Borough of Smethwick.**
BEARWOOD BATHS.
HEATING AND FILTRATION.
TO HEATING ENGINEERS.

The Estate Committee is prepared to receive TENDERS from reputable firms of Heating Engineers for the SUPPLY and INSTALLATION of LOW-PRESSURE STEAM BOILERS, PUMPS, ELECTRIC MOTORS, PIPING, and the whole of the PLANT required in connection with the HEATING of the SWIMMING BATHS WATER, HOT WATER SUPPLY to SLIPPER BATHS, &c., and the HEATING of the BUILDING in connection with the above scheme.

TO FILTRATION ENGINEERS.

The Committee is also prepared to receive TENDERS for the SUPPLY and INSTALLATION of a complete FILTRATION PLANT to deal with the Swimming Baths Water.

Firms desiring to Tender for either Plant should communicate at once with the undersigned, enclosing deposit of £5, when plans and particulars will be forwarded.

Separate Tenders are required for the Heating and Filtration Plant, and must reach the undersigned not later than first post on Monday, 12th January, 1931.

ROLAND FLETCHER, A.M. Inst. C.E.,
Borough Engineer.

Council House, Smethwick,
1st December, 1930. 6172

**County Borough of Southend-on-Sea.**
TO CONTRACTORS.
"SANDBERG" STEEL TRAMWAY RAILS.
BRITISH MANUFACTURE.

The Corporation are prepared to receive TENDERS for the SUPPLY and DELIVERY of 100 Tons of "SANDBERG" STEEL TRAMWAY RAILS, consisting of B.S. Sections Nos. 7 and 7C.

General conditions, form of Tender, and specification may be obtained on and after Tuesday, 9th December, on application to Mr. Robert H. Dyer, Borough Engineer and Surveyor, on payment of a deposit of One Guinea, which will be refunded on receipt of a bona fide Tender and the return of all loaned documents.

Sealed Tenders, addressed to the undersigned and endorsed "Steel Rails," are to be delivered to this office on or before 9 a.m., Tuesday, 23rd December, 1930.

The Corporation do not bind themselves to accept the lowest or any Tender.

H. J. WORWOOD,
Town Clerk.

Municipal Buildings,
Clarence-road, Southend-on-Sea,
6th December, 1930. 6184

### PUBLIC NOTICES

**City and County of Kingston-upon-Hull.**

APPOINTMENT OF DEPUTY CITY ENGINEER.

The Corporation of Kingston-upon-Hull invite APPLICATIONS for the APPOINTMENT of DEPUTY CITY ENGINEER, at a salary of £750 per annum, rising by four annual increments of £25 to £850 per annum.

The person appointed must be a fully qualified Civil Engineer and will be required to devote his whole time to the duties of the office and not engage, directly or indirectly, in any other occupation.

The position is a designated post under the Local Government and Other Officers' Superannuation Act, 1922, and the salary will be subject to a deduction of contributions to the Superannuation Fund. The successful candidate will also be required to pass a medical examination and to reside within the city.

Forms, on which application should be made, may be obtained from the undersigned.

Applications, endorsed "Deputy City Engineer" and addressed to the Town Clerk, Guildhall, Hull, must be delivered at the Town Clerk's Office, Hull, not later than the 23rd December, 1930.

J. R. HOWARD ROBERTS,
Town Clerk.

Guildhall, Hull,
28th November, 1930. 6188

**Union of South Africa.**
DIRECTOR FOR FUEL RESEARCH INSTITUTE.

APPLICATIONS are INVITED for the above DIRECTORSHIP.

ENGAGEMENT.—In the first instance for a period of three years.

SALARY.—£1000 with two increments of £100 to £1200 per annum maximum.

Applications, with copies of testimonials, all in triplicate, must reach the SECRETARY, Office of the High Commissioner for the Union of South Africa, 73, Strand, W.C. 2 (from whom application forms and further particulars may be obtained), not later than December 15th, 1930. 6093

### PUBLIC NOTICES

**Metropolitan Water Board.**
MAINS FOR THE IMPROVEMENT OF SUPPLY, ESHER AND THE DITTONS, &c.

The Metropolitan Water Board invite TENDERS for the LAYING of the undermentioned MAINS :—

(A) 2960 Lineal Yards of 24in. Diameter Cast Iron Main from the Board's Surbiton Works, Portsmouth-road, Surbiton, to Kingston By-pass Road at its junction with Hook-road.
(B) 2835 Lineal Yards of 18in. Diameter Cast Iron Main along Kingston By-pass Road to Tolworth.

All in the Urban District of Surbiton, in the County of Surrey.

The drawings and contract documents may be inspected without charge at the Offices of the Board, Chief Engineer's Department (Room 201).

Forms of Tender, conditions of contract, specification and bills of quantities, together with drawings and a spare copy of the bills of quantities, may be obtained on and after Monday, 15th December, 1930, from the Chief Engineer, on production of an official receipt for the sum of £10, which must be deposited with the Accountant to the Board and which will be returned on receipt of a bona fide Tender accompanied by all the above-named documents and drawings (with the exception of the spare copy of the bills of quantities, which may be retained by the tenderer). Such payments and applications must be made between the hours of 10 a.m. and 4 p.m. (Saturdays, 10 a.m. and 12 noon). Cheques must be made payable to the Metropolitan Water Board and not to individuals.

Tenders, enclosed in sealed envelopes, addressed to the Clerk of the Board and endorsed "Tender for Mains, Esher, &c.," must be delivered at the Offices of the Board (Room 122) not later than 11 a.m. on Monday, 12th January, 1931.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1,
3rd December, 1930. 6189

**Administrative County of** LONDON.

The London County Council has VACANCIES for HANDICRAFT MASTERS with qualifications in Metalwork to assist in the undermentioned Central Schools :—

(i.) Jews' Free (32), Bell-lane (Whitechapel and St. George's).
(ii.) Thomas-street (40), (Limehouse).

Candidates should be fully qualified Handicraft Masters, but applications will be considered from skilled craftsmen with some teaching experience who have passed the First Examination for Teachers of Handicraft (Metalwork) of the City and Guilds of London Institute.

Salary: Burnham Scale IV., for certificated teachers, in the case of fully qualified Handicraft Masters, and in the case of skilled craftsmen, as above, £160, fixed pending completion of qualifications. There is also the possibility of becoming entitled ultimately to an allowance in respect of Central School work in each case.

Apply, Education Officer (E. 2), the County Hall, Westminster Bridge, S.E. 1 (stamped, addressed, foolscap envelope necessary), for form, to be returned by 20th December. Canvassing disqualifies.

MONTAGU H. COX,
6166 Clerk of the London County Council.

**Borough of Ilford and Barking** TOWN URBAN DISTRICT COUNCIL.
JOINT SEWERAGE SCHEME.
APPOINTMENT OF CLERK OF WORKS.

APPLICATIONS are INVITED for the above APPOINTMENT in connection with Contracts under the Ilford and Barking Joint Sewerage Scheme, at Barking, Essex, at a salary of £7 per week.

Applicants should be not less than 25 years of age and must have had experience in Supervising the Construction of Concrete Tanks in bad ground and large Pumping Stations. The successful applicant will be required during the first three months to Supervise Night Work.

The appointment is expected to extend over a period of 12 months and will be determinable by one week's notice on either side.

The successful applicant will be required to reside within the district and act under the instructions of the Joint Committee's Consulting Engineers and their Resident Engineer.

Applications, endorsed "Clerk of Works," stating age, present employment, qualifications and experience, and date when able to commence duties, accompanied by copies of not more than 3 recent testimonials, must be addressed to the undersigned and received not later than the first post on Monday, December the 8th, 1930.

By Order of the Joint Committee of the above Authorities.

ADAM PARTINGTON,
Clerk to the Joint Committee.

Town Hall, Ilford, Essex,
28th November, 1930. 6168


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## PUBLIC NOTICE

# Government of Bombay.

## NOTICE.

**To IRRIGATION DEPARTMENTS, PORT AUTHORITIES, RAILWAYS, MUNICIPALITIES, ELECTRIC SUPPLY COMPANIES, PUBLIC WORKS CONTRACTORS AND OTHER ADMINISTRATIONS CARRYING OUT LARGE ENGINEERING WORKS.**

Notice is hereby given that,owing to the approaching completion of the Lloyd Barrage at Sukkur, large quantities of Plant and Machinery as briefly detailed in the list below will shortly become available for sale. The bulk of the plant will not be available until after June, 1931, but some plant is now available and other plant will become available shortly.

All Administrations who have works in progress or who are contemplating works in the near future are invited to consider the subjoined list and to apply to the undersigned for full particulars and prices of any plant which might be of use to them. Enquiries are nor invited from machinery dealers at the present stage. Most of the plant was purchased new for these works and is in excellent condition. Every item of plant sold will be first overhauled and put in thorough working order before sale and will be open for inspection (and test, wherever possible) by appointment at Sukkur.

Service will also be given after sale and purchasers' men will be trained by arrangements, as long as the Barrage Construction Works and Shops are in existence.

A. A. MUSTO,
C.I.E., M.I.C.E., I.S.E.,
Superintending Engineer, Lloyd Barrage Circle.
Postal Address :
Sukkur, Sind, India.

### LIST OF PLANT & MACHINERY.

**RAILWAYS.**
About 40 miles of 5ft. 6in. gauge Railway complete and 9 Steam Locomotives and about 700 Wagons of all types, including 20-Ton Either-side Tipping Wagons. About 25 miles 2ft. gauge Railway complete and 15 Kerosine and 2 Steam Locos. and about 1100 Either-side Steel Tip Wagons of 27 cubic feet capacity.

**FLEET.**
Two Shallow-draught Suction Dredgers, by Lobnitz, 20in. discharge, to dredge to 30ft. each, complete with 1000ft. Floating Pipe Line and Terminal Pontoon with 150ft. overhang at 40ft. above water line.
Also Shallow-draught Paddle and Twin-screw Tugs, Motor Launches, Steel Barges, Pontoons, &c.
NOTE.—All motors on electrically driven plant are for A.C., 440 volts, 3-phase, 50 periods.

**CRANES.**
25-Ton and 10-Ton Electric Floating Derrick Cranes, 10-Ton and 14-Ton Electric Derrick Cranes, 20-Ton and 2-Ton Steam Derrick Cranes. Also 5-Ton Steam Loco. Cranes and 10-Ton Electric Loco. Cranes, 5ft. 6in. gauge. Also 15-Ton, 12-Ton and 5-Ton Electric Goliath Cranes, 15-Ton Electric Shop Gantry Crane, and 10-Ton Hand-operated All-round Derrick Cranes.

**PUMPS.**
Sets of 8in., 4in., 3in., and 2in. Direct-coupled Electric Centrifugal Pumps for 40ft. head.

**PILE DRIVERS.**
Floating and Land Sets with McKiernan-Terry Double-acting Piling Hammers, Spencer-Hopwood Rollars, Zenith Winches and Steel Frames and Leads for driving 45ft. Piling.

**STONE CRUSHERS.**
"Acme" Jaw Crushers, 24in. by 15in., with Elevators, Hoppers and Screens and Portable, Crusher, 12in. by 6in.

**CONCRETE MIXERS.**
Complete Plants for Moulding 10-Ton Blocks with Travelling Mixer Bridge carrying 2-Yard Ransome Mixers complete with Bunkers, Elevators and Batch Measuring Hoppers for materials, all electric driven. Also Steel Moulds for 10-Ton and 14-Ton Blocks. Also Electric-driven Portable Mixers of sizes.

**AIR COMPRESSORS.**
Direct-coupled Electric-driven Sentinel Two-stage Compressors of 300 cubic feet capacity. Belt Drive Ditto of 550, 300, 188, and 140 cubic feet capacity respectively. Pneumatic Tools of all kinds.

**DIVING GEAR AND DRESSES, &c.**

**ELECTRIC POWER PLANT.**
Following Diesel Engines direct coupled to Alternators generating A.C., 6600 volts, 3-phase, 50 periods :—
2 Swiss Locs. 4-Cylinder Single-acting Diesels, 750 B.H.P., with Fly-wheel Alternator, 500 kW. by Oerlikon.
2 Fullagar 4-Cylinder Double-acting Diesels, 750 B.H.P., with Fly-wheel and Alternators, by English Electric Co., 500 kW.
2 Mirrlees, Bickerton and Day 6-Cylinder Single-acting Diesels, 300 H.P., with Metro-Vickers Alternators, 175 kW.
Metro-Vickers Cubicle Type Switchboard.
Johnson and Phillips Transformers, 6600 to 400 volts, of sizes.
H.T and L.T. Overhead Transmission Poles, Cables, &c.

**MORTAR MILLS.**
Both Over-driven and Under-driven Type Mortar Mills, 8ft. dia. pans, with belt drive from countershaft.

**WORKSHOP MACHINERY.**
Lathes, Sharers, Planers, Milling Machines, Drilling Machines, Belt Air Hammers, Belt Hammers, Punching and Shearing Machines, Forges, Woodworking Machinery, Plate Rolls, Iron and Brass-foundry Equipment, Saw Sharpening Machines, &c.

**QUARRY PLANT.**
Compressed Air Drills of all sizes, Forging Machines, Oil Furnaces, Air Compressors, Oil Engines, Wire Saws, Channellers, &c.

**STONE DRESSING PLANT.**
Diamond Saws, Planers, Frame Saws, Rip Saws, Countershafts, &c.

**ENGINES.**
Oil Engines of various sizes.

**BUILDINGS.**
Steel-framed Stone Dressing Shop, 360ft. by 115ft., with 15-Ton Gantry Runway and numerous Smaller Steel Roof Trusses, &c.

**STEEL SHEET PILING.**
About 11,000 Tons "Universal" 15in. by 5in. by 43 lb. per square foot Interlocking S.S. Piling in 40ft., 45ft., and 50ft. lengths.

**MISCELLANEOUS PLANT.**
Such as Steel Riveted and Sectional Tanks of all sizes, with and without Staging, Winches, Jacks, Pulleys, Wire Ropes, Motor Lorries, and many other items.

A. A. MUSTO,
S.E.L.B.C.

MB.12/10. P.B. 40/30. 6060

## PUBLIC NOTICES

# Wolverhampton Corporation

WATER UNDERTAKING.
ENGINEERING ASSISTANT.

APPLICATIONS are INVITED for the POST of ENGINEERING ASSISTANT at a salary of £210 per annum, rising by annual increments of £10 to £270 per annum, in accordance with the Corporation's Salary Grading Scheme, and subject to percentage deductions in accordance with the Local Government and Other Officers' Superannuation Act, 1922. The selected candidate will be required to pass a medical examination.

Applicants must have had Civil Engineering training. Applications, stating age, qualifications and experience, together with copies of three testimonials, must be delivered to the undersigned on or before the 29th of December, 1930. Envelopes are to be endorsed "Engineering Assistant."

B. L. McMILLAN,
Water Engineer and Manager.

Town Hall, Wolverhampton,
1st December, 1930. 6169

## SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, PRODUCTION ENGINEER for Works employed in manufacture of Internal Combustion Engines. Must be experienced in modern tooling methods as applied to batch production. State age and salary required to "BATCH," Wm. Porteous and Co., Advertising Agents, Glasgow. P575 A

WANTED, CHIEF ENGINEER for Large Paper Mill in the East. Must have had extensive general engineering experience, together with good knowledge of modern power and steam practice as applied to Grass Paper Mills. Mill in healthy locality. Good terms to suitable applicant.—Write, Z.H. 852, c/o Deacon's Advertising Agency, Fenchurch-avenue, E.C. 3. 6181 A

ENGINEER SALESMAN REQUIRED for India. Age about 25, well educated, some knowledge Civil Engineering. State full particulars, salary, &c.—Address, 6180, The Engineer Office. 6180 A


# FOR SALE

STEAM PLANT, BOILERS, ECONOMISERS, STEAM AND WATER PIPING, VALVES AND FITTINGS, TURBINES, TURBO-EXHAUSTERS, CONDENSING PLANT, PUMPS, ETC.

LOCOMOTIVES, RAILWAY METALS, WEIGHBRIDGES UP TO 30 TONS.

MINING PLANT, RAILS, TUBS, HOISTS, WINDING ENGINES, TUB WEIGHBRIDGES, COAL CUTTERS (BAR AND CHAIN TYPE), HOPPERS, WINCHES, AIR COMPRESSORS, ELECTRIC MOTORS FOR COLLIERY AND OTHER USES.

ELECTRIC TRUCKS, 2 TONS CAPACITY.

*For particulars of the above and other plant for disposal write to:*

**THOMAS HINDLEY LTD.,**

HEAD OFFICE AND WORKS:

**54, CITY ROAD, DERBY.**

Telephone: DERBY 2595. HIRE PURCHASE TERMS ARRANGED.


## PUBLIC NOTICES

# Metropolitan Borough of PADDINGTON.

APPOINTMENT OF ASSISTANT BATHS SUPERINTENDENT.

APPLICATIONS are INVITED for the APPOINTMENT of ASSISTANT SUPERINTENDENT of the Paddington Central Baths and Porchester Hall, at a salary of £250 per annum, rising by two annual increments of £25 to £300 per annum.

The age of candidates must not exceed 40 years, and previous experience in the management of a Baths Establishment and Public Hall is essential.

The person appointed must produce a certificate of birth confirming statement of age, pass an examination by the Council's Medical Examiner, contribute to the Council's superannuation scheme, devote the whole of his time to the duties of his office, and not be directly or indirectly concerned in any business other than that of the Council.

Forms of application for the appointment may be obtained from the undersigned on receipt of stamped addressed foolscape envelope, and must be returned to me not later than 10 a.m. on Wednesday, 31st December, 1930.

Personal canvassing, either directly or indirectly, will be a disqualification.

By Order,
W. F. ABBISS,
Town Clerk.

Town Hall,
Paddington, W. 2,
3rd December, 1930. 6185

## SITUATIONS OPEN (continued)

ENGINEER.—ASSISTANT, Not Over 35 Years of age; must have experience Steel Roof Design, Construction and Estimating. State experience, age, and salary required.—Address, P576, The Engineer Office. P576 A

PRODUCTION ENGINEER REQUIRED in Factory manufacturing Switchgear of all kinds. Good electrical knowledge is necessary. Applicants should state salary required and give full particulars of experience.—Address, 6192, The Engineer Office. 6192 A

REPRESENTATIVE WANTED for the Sale of Precision Grinding Machines. State experience, age, and salary required.—Address, 6191, The Engineer Office. 6191 A

STRUCTURAL DESIGNER and ESTIMATOR for London Office, with thorough knowledge of competitive design of Roofwork, Sheds, Steel-frame Buildings, &c. State age, experience, and salary required.—Address, P580, The Engineer Office. P580 A

TECHNICAL MANAGER WANTED for Old-established engineering firm. Intimate knowledge of modern Papermaking Machinery essential.—Apply, with references and full particulars of experience, stating age and salary expected, to "TECHNICAL," Wm. Porteous and Co., Glasgow. P581 A

**For continuation of Small Advertisements see page 96.**


# IRON CASTINGS

BY THE LANZ PERLIT AND THYSSEN EMMEL PROCESSES; HEAT RESISTING PROPERTIES, HIGH TENSILE AND HOMOGENEOUS STRUCTURE.

**The Caledon Shipbuilding & Engineering Co., Ltd., DUNDEE.**



# SALE OF FLOATING PLANT

**(Dredging and Transport).**

The "Compagnie du Canal de Suez" offers for sale by private treaty the undermentioned plant, which no longer answers the Company's requirements.

| Description | Length | Breadth | H.P. (C.V.) | Capacity of Buckets | Hopper Capacity | Speed at Trials |
|---|---|---|---|---|---|---|
| | ft. | ft. | | c.ft. | c.ft. | knots. |
| Marine Dredger No. 14 .. .. | 180 | 40 | 500 | 14 | — | 6 |
| Dredgers with long conveyors, Nos. 18 and 20.. .. .. .. .. | 115.2 | 34.5 | 160 | 10½ | — | — |
| Dredger with medium length conveyor, No. 25 .. .. .. .. | 85.3 | 26.3 | 80 | 7 | — | — |
| Stone Hopper Barge "Guiseh" No. 55 .. .. .. .. .. | 137.5 | 25 | 300 | — | 7064 | 7½ |
| Stone Hopper Barge "Zagazig" No. 70 .. .. .. .. .. | 137.5 | 25 | 300 | — | 7064 | 7½ |
| Tank No. 94.. .. .. .. .. | 78.8 | 15.8 | 55 | — | 2472 | 5·9 |
| Steam cutter "Ibis" No. 101 .. | 87 | 16 | 140 | — | — | 8·9 |
| Steam cutter "Flamant" No. 135 | 44.6 | 10 | 50 | — | — | 8·9 |
| 35-ton steam sheer No. 818.. .. | 73.8 | 33.5 | 35 | — | — | — |

The above plant is lying at Port Said (Egypt) where it can be inspected, and where delivery would be given. Offers are to be made to the Head Office of the Suez Canal Co., 1 rue d'Astorg, Paris.

Further information as to present state of above plant will be given on demand.

Particulars believed correct, but not guaranteed.

# A Seven-Day Journal

## The Grampian Hydro-Electric Scheme.

ON Sunday last, November 30th, with a minimum of ceremony, the new hydro-electric station which has been built by the Grampian Electricity Supply Company at Ardlarich, on the north side of Loch Rannoch, was successfully put into service. At 11.40 a.m. the current was synchronised with that of the "Grid" of the Central Electricity Board at Abernethy, and switched on by Mr. George Balfour, who is chairman of Balfour, Beatty and Co., Ltd., the engineers and contractors for the work. Since then, so we understand, everything has worked smoothly and satisfactorily, a maximum demand in the neighbourhood of 15,000 kilowatts having been experienced. The Ardlarich station forms part of an extensive scheme for utilising the water powers of a wide area of the Highlands of Perthshire, which is being carried out by the Grampian Electricity Supply Company. The present station—the first to be completed—is operated by water derived from Loch Ericht, which is led to the power-house through a tunnel and steel pipe lines, a head of some 490ft. being made available. At the present time the power-house is equipped with two 20,000 horse-power, vertical-spindle turbines, which run at 500 revolutions per minute, and each is coupled to a three-phase alternator which generates 50-period current at 11,000 volts. For transmission to Abernethy that pressure is stepped up in an outdoor transformer station to 132,000. The company has also a transmission line, operating at 33,000 volts, for supplying the area which it controls.

## The Royal Society and Scientific Research.

AT the 268th anniversary meeting of the Royal Society, which was held on Monday last, December 1st, Sir Frederick Gowland Hopkins was elected President in succession to Sir Ernest Rutherford, O.M. In his anniversary address, Sir Ernest spoke of some of the ways in which the Society was responding to new opportunities for the promotion of science. The endowment of research fellowships had, he said, proved an unqualified success, and the Society had encouraged research by minor grants of apparatus and material. He felt, however, that the situation was entirely different in large-scale investigations of a pioneering character, which might require considerable financial support, extending over a period of years. The Council had decided that it could best help the advance of science by assisting major researches of that character. After careful consideration, the Council was impressed with the fundamental importance of the researches which were being carried out by Dr. Peter Kapitza, F.R.S., at Cambridge, and the need for continuing that work on a more permanent basis. The Council has therefore appointed Dr. Kapitza to a Messel Professorship of the Royal Society, and has offered the University of Cambridge £15,000 for the building of a laboratory suited to the needs of his investigations. It will be recalled that in 1922 Dr. Kapitza began his experiments to test the possibility of obtaining intense magnetic fields by sending very strong currents through a coil for such a short interval that the heating effect was restricted to a permissible value. By using special accumulators giving intense currents for one-fiftieth of a second, fields up to 200,000 Gauss were obtained. Later on a special generator was built to apply a short-circuit current of about 70,000 ampères for one hundredth of a second to a special coil and fields of 300,000 to 400,000 Gauss have thus been created over a volume of about 3 cubic centimetres. For the study of magnetic phenomenon at extremely low temperatures a liquid hydrogen plant has been built and arrangements made to supply a liquid helium plant if it is required.

## Power Plant for Holland.

DURING the early hours of November 30th, a special train, containing power station plant, left Newcastle-on-Tyne. It was timed to reach Harwich at 4.15 on the following morning, and it was shunted on to the train ferry, which left for Zeebrugge in the evening. The train contained the second consignment of machinery ordered by the Provencial Electriciteitsbedrijf van Nord for the new power station at Velsco, Holland. Two 24,000 kW turbo-alternators were carried on the train, which was composed of 24 wagons, one being a well trolley wagon weighing nearly 39 tons and conveying a stator of 65 tons, making a single wagon load of 104 tons, the heaviest ever loaded on the train ferry. The next in weight was an armour plate wagon of 31½ tons, carrying pieces of machinery weighing 37½ tons, making 69 tons in all. Shortly after midnight on Saturday, November 29th, the train left Messrs. C. A. Parsons' works at Heaton Junction, and as some of the machinery was so large as to overhang the wagons considerably, it was necessary to keep the adjoining track clear throughout the journey of 280 miles to Harwich. A good deal of preparation had to be carried out by the London and North-Eastern Railway Company, for, at some places, it was necessary to lower the lines to enable the train to pass under bridges. At Chappel, the line was slewed and smoke plates under the bridge were removed, whilst at Sudbury it was not only necessary to remove the smoke plates, but also to run the train on the wrong line in order to prevent the load hitting the side of the bridge. At a bridge near Shelford, the line was lowered, and at Haxey, near Doncaster, the train was run right across all the lines to the down line on the far side, for if this had not been done it would have run so close to a passenger train as to present danger. The train is to be run over the Belgian railways to Holland.

## The New Cunard Liner Begun.

ON Monday last the contract between the Cunard Steamship Company, Ltd., and John Brown and Co., Ltd., of Clydebank, for the building of the new express liner was sealed and signed at a special Cunard board meeting held in Liverpool. For some time past the building berth has been in course of preparation and the laying down of the keel has now been begun. The principal dimensions of the new Cunarder were recently referred to in a parliamentary discussion and the gross tonnage was given as 75,000; the length as 1018ft. and the capacity as 7,300,000 cubic feet. No official announcement has yet been made with regard to the propelling machinery for the new ship, but it is generally understood that quadruple-screw Parsons turbines with single-reduction gearing will be installed and that steam will be generated in a modern installation of high-pressure oil-fired boilers of the Yarrow water-tube type. The Clyde Navigation Trust has agreed to proceed with the widening of the river Clyde so that the new liner can be safely launched and when completed can proceed down the river. The work of widening and deepening the Clyde will cost about £79,000. A section of land will have to be cut away from the west bank of the river Cart opposite to the Clydebank Shipyard, and the river channel will have to be widened at the bend at Rashielee Light, on the south side of the river nearly opposite the Dalmuir sewage works. The new liner is expected to be launched at the end of May, 1932, and will probably go down the river in the September of the following year.

## A Large Graving Dock for Southampton.

IN order to meet the wish of the Cunard Steamship Company, Ltd., that dry docking accommodation should be available at Southampton for the new Cunard liner, the directors of the Southern Railway Company have agreed to build a new graving dock which will have a length of 1200ft., an entrance width of 135ft., and a depth of 45ft. No definite site for the dock has yet been decided upon. One possible site is that adjacent to the new dock extension works on the Millbrook shore, which includes the new Cunard berths, part of which, it is hoped, will be ready for service early next year. Another alternative site is the Weston foreshore on the Netley side of Southampton Water, where land is owned by the railway company, and where in the past it has been suggested that a big dry dock might be constructed. The new 1200ft. dry dock will be the seventh to be constructed at Southampton, if the floating dry dock be excluded, and it is hoped that it will be ready for service in 1933. As already mentioned in our Journal note of October 10th, the railway company has given serious consideration to the proposal to enlarge the present floating dry dock. The decision, however, to build a graving dock may be taken as a possible indication that although the construction costs for the graving dock may be heavier, the upkeep charges will be less. In order to prepare the bed for the present floating dry dock it was necessary to dredge to a depth of 65ft. and to remove about 940,000 cubic yards of soil, and the desired depth has only been maintained at a heavy expense for dredging, owing to the constant silting up of the bed. The new graving dock will be the largest in the world. The Southern Railway Company has also decided to put in hand immediately the second part of its Southampton dock construction scheme.

## The Assuan Dam.

IT was announced on Monday at Cairo that the Council of Ministers had decided to award the contract for continuing the work of heightening the Assuan Dam to Topham, Jones and Railton, of London. It is understood that the contract price makes allowance for the plant and machinery already at the site of the dam, and that it amounts to £E. 2,100,000. The original contract for the work was awarded in November last year to Sir John Norton-Griffiths and Co., but difficulties arose and work was suspended in September this year, Sir John Norton-Griffiths shortly afterwards being found dead. Among the original tenders that of the new contractors was third.

## A Travelling Electrical Showroom.

YESTERDAY—Thursday—the County of London Electric Supply Company, Ltd., exhibited a new travelling showroom at Rochford, Essex. It was specially built by the Howcroft Carriage and Engineering Company, Ltd., of West Hartlepool, for the purpose of popularising electricity and to demonstrate the working of the latest electrical appliances to the inhabitants of the villages and smaller towns in the rural areas. The vehicle is staffed by a manager and attendants, who are qualified to give full information regarding the supply of electricity and the price of all kinds of electrical appliances. When closed for travelling, the vehicle is no larger than an ordinary pantechnicon van, but when it it arrives at its destination it opens telescopically and gives a superficial area of 484ft. It is panelled in mahogany, and is fitted with all the latest types of electric lamps and shades, fires of various kinds, cookers, washers, mangles, hot water apparatus, and various other electrical devices for use in the home. Complete with its equipment the vehicle weighs about 6 tons, and it is hauled from place to place by a special lorry. Current for operating the various electrical devices is drawn from the County of London Supply Company's mains.

## The Science Museum.

THE report for the year 1929 on the Science Museum, South Kensington, shows clearly that that institution is very rapidly becoming as popular with the general public as the Zoo, Madame Tussaud's, the Tower and other sights of London. Since 1925, the popularity of the Museum has increased steadily from year to year. Up to that year it had never attracted more than about half a million visitors at the most per annum. In 1925, the visitors numbered nearer 400,000 than 500,000, but each year since then there has been a growth of a large and remarkably steady kind. Last year the visitors for the first time surpassed the million mark, the exact figure being 1,061,754. It is not without significance, perhaps, that the favourite times for visiting the Museum are Saturdays and Sunday afternoons, and that April and August, year after year, consistently show the highest monthly attendances. During 1929, the Sunday afternoon visitors amounted to 27 per cent. of the year's total, and have ranged in number from 7000 up to, on one occasion, 18,125. The popularity of the Museum is, in fact, so great at the week ends that the galleries are often inconveniently crowded. The Museum is not only overcrowded at times by visitors, but is permanently overcrowded as regards space for its exhibits, in spite of the fact that the new East Block was opened as recently as 1928. In certain groups additions can only be made to the exhibits by withdrawing some already on show. This condition will continue until the new Centre Block is provided. The Museum makes a special appeal to young visitors, and more children are said to visit it than any other museum in London. It has, however, been noted that the proportion of those who visit it for the serious study of the collection is growing larger and that the public appreciates, and is freely availing itself of, the technical information which it can obtain from the official lecturers and attendants.

## L.M.S. Experimental Road Tractor.

WITH a view to providing a substitute for horses for haulage in goods yards and for the collection and delivery services in large towns, a new type of road tractor has been built for the London, Midland and Scottish Railway Company by Karrier Motors, Ltd. It was designed by the company's road motor engineer, Mr. J. Shearman, and is built to draw a load of 3 tons at a speed of 18 miles per hour, and to restart on a gradient of 1 in 8. The new tractor was demonstrated at the company's Camden Town goods yard on Wednesday, December 3rd, and further experimental tests are to be made at stations in London, Birmingham, and Manchester. Small-scale experiments have indicated, we understand, that the new tractor will perform the work of two horses at the cost of one and a quarter.

## The R101 Inquiry.

ON Wednesday, Sir John Simon, assisted by Lt.-Col. Moore-Brabazon and Professor Inglis, resumed the public inquiry into the loss of the "R 101." The outstanding evidence tendered on the first day of the resumption was that submitted by Professor Bairstow, Chairman of the Airworthiness of Airships Panel of the Aeronautical Research Committee. Professor Bairstow reported the results of certain investigations which were conducted during the interval in the Court's sittings. He stated that a model of the airship, representing the vessel as altered by the addition of the extra bay, had been tested in a wind tunnel at the National Physical Laboratory. It was found, he said, that the additional bay altered the drag, lift, and pitch, but not to an unexpected extent, and that it did not materially affect the ship's previous stability. Professor Bairstow also reported the results of certain calculations which he had made concerning the ability of the elevators to maintain the ship in horizontal flight at 55 knots when the forward gas bags were in various states of partial inflation. He said that the power of the elevators was sufficient to maintain horizontal flight when any one of the forward gas bags was completely deflated, but that he was not sure of the effect which would be produced if two of the forward bags were deflated. In the case of the gas bags numbered 3 to 8 progressive deflation to 60 or 70 per cent. of the full capacity would give a pitching moment greater than could be dealt with by the elevators.

## Renewal of Folkestone Harbour Swing Bridge.

THE old wooden swing bridge leading to the Folkestone Harbour Station of the Southern Railway was, as we briefly notified at the time, replaced during the week-end May 10th–12th by a new steel structure. The displaced bridge, which had been in service since 1893, spanned the opening leading to the Inner Harbour. It was of the double bowstring type, having three main girders. It was built for two lines of rails and it had been strengthened from time to time, notably by the addition, a number of years ago, of three timber posts, one in the centre of each main girder, and supporting tie rods, and later by the replacement of the original decking by something more substantial. It was, however, even with those additions, deemed to be incapable of supporting the heavy weights of the locomotives necessary to meet the requirements of modern traffic conditions, and a couple of years or so ago it was decided to replace it.

FIG. 1—FOLKESTONE HARBOUR STATION AND OLD WOOD SWING BRIDGE

Folkestone Harbour, it may be remarked in passing, was not, originally, owned by the Railway Company, but was in existence a number of years before the old South-Eastern Railway Company was constituted. It was built by Telford about the year 1809, and was, at first, apparently, not a commercial success.

The purchase by the S.E.R. was effected in 1843—the year the line reached Folkestone—but for the succeeding five years the harbour branch was only used as a goods line. In 1848, however, it was passed as a passenger line by the Board of Trade, and the bridge, which was then used to span the entrance to the Inner Harbour, was replaced in 1893 by the bridge which has just been demolished and which was built by Mr. James Brady, the then engineer to the South-Eastern Railway. The relative positions of the bridge and the Harbour Station are shown in Fig. 1.

It may be explained that, unlike Dover, where the boat trains can be taken direct alongside the boats by main line engines, it is necessary, at Folkestone Junction Station, to reverse the direction of travel of the trains and to take them down to the Harbour Station by other engines. The difference in level between the Junction and the Harbour Stations is some 111ft., and the distance by rail between the two stations is about 1328 yards. That is to say, the average gradient is 1 in 36, while the maximum gradient is as steep as 1 in 30. With the old wooden swing bridge only comparatively light tank engines were employed, and it was often necessary, in times of heavy excursion traffic, to use as many as four of these engines—two pulling and two pushing—to take the long, heavily-loaded excursion trains up the incline. That meant that at least four engines and crews had to be kept continually ready for service, which was, as will be readily realised, an expensive business. With the new bridge, which is designed to carry the heaviest locomotives in service on the line, it will rarely be necessary to employ more than two locomotives—one pulling and the other pushing—while at ordinary times a single locomotive will be able to perform the work.

By the courtesy of Mr. George Ellson, O.B.E., M. Inst. C.E., the chief engineer of the Southern Railway, to whose designs the new bridge was built, we were permitted to inspect the new structure and are enabled to put before our readers the following particulars of the work and to illustrate them by the engravings which accompany this article and are given in our Supplement of to-day.

On going into the matter it was ascertained that it would not be necessary to replace, or indeed to modify, to any great extent, either the centre pier on which the bridge revolves or the two abutments, all of which are masonry structures founded on piles. The pier is square, measuring about 32ft. each way, with rounded corners. It stands midway between the two abutments, and two free openings, one on either side of it, and each some 50ft. wide, are available when the bridge is swung open.

Since it is only rarely that large craft have to enter the Inner Harbour, the bridge has to be opened but seldom as compared with a swing bridge over a busy fairway, because, even at highest high water, small craft can pass under it. Power-operated mechanism was not, therefore, provided on the old structure, and the same course has been followed with the new bridge. The actual swinging of the bridge was, and is, effected by means of a crane or an electric capstan on the wharf and a rope, and, as we shall show later, the lifting and locking mechanisms on the new bridge are hand-actuated.

In our Supplement—Drawing No. I.—are given elevations of the old and the new bridges, while photographs of the two structures are reproduced herewith in Figs. 2 and 3, and other views showing the old and new bridge are given on page 624. It will be observed from the drawings that highest water level—which represents a depth of 22ft. on the gauge at the Pier Head—actually came above the level of the underside of the old bridge, so that the rollers and roller path were immersed at each highest tide and frequently at the tops of lesser tides. In the new bridge it was possible so to design the girders that their depth was less than the depth of the old wooden girders and the rollers and roller path of the new bridge are set well above any but the very highest water level, which is only experienced with exceptionally high spring tides that are very rare.

The new bridge has three main longitudinal steel girders, each of the outer girders being made up of two side or end portions and a centre portion. Drawings of the side portions of the outer and centre main girders are given in the Supplement—Drawing No. II. The outer main girders taper in depth from 9ft., where they join the centre portion, to 6ft. 7½in. at the outer ends. They are set at 23ft. 1¼in. centres apart and are built up of ½in. web plates and 6in. by 6in. by ⅝in. main angles with flange plates both top and bottom 24in. wide and ⅝in. thick. Vertical stiffeners comprising two 6in. by 4in. by ½in. T's are arranged, generally, at 5ft. centres apart. The centre portion of the girders is also illustrated in one of the drawings in the Supplement—No. III.—which also shows the steel work of the centre portion of the bridge. The ends of the bridge are curved to a radius of 70ft. 1in. and the greatest length of the outer main girders is 138ft. 3 7/16in.

The centre main girder differs considerably in construction from the outer girders. In the first place, it is in two parts, each of them 61ft. 5in. long, and there is no straight centre portion. In effect, therefore, the centre girder forms two distinct spans, the inner ends of which are carried by cross bearers, in turn carried by the radial girders to the circular girder, which is supported by the ring of live rollers referred to later. For 44ft. in the centre of the length of each girder the web plates, which are ½in. thick, are 5ft. 7½in. deep. In the last 3ft. 10in. in its length, however, at the circular girder end, the depth is tapered from 5ft. 7½in. to 4ft. 7in. At the other end of the girder, which is the abutment end, the web plate, which is ⅝in. thick, tapers from 5ft. 7½in. to 2ft. 11½in. deep, and keeps that depth for the remainder of its length. The main angles, top and bottom, are 6in. by 4in. by ⅝in., and both at the top and the bottom the flange plates are 16in. wide and of 2in. total thickness at mid-span. The stiffeners, which are generally at 5ft. centres, comprise either two 6in. by 4in. by ½in. T's or four 3½in. by 3½in. by ½in. L's.

The centre portion of the bridge is formed by a circular girder or drum which has a diameter of 25ft. 7½in. at the outer edge of its top flange plates. Drawings of this portion of the structure are given in our Supplement—Drawing No. III. The girder is made up of two web plates, an inner and an outer, the inner curved to a radius of 11ft. 6⅝in. and the outer to a radius of 12ft. 5⅛in., the two webs being arranged parallel to one another at 10⅝in. apart from centre to centre. The depth over the flange plates is 3ft. 7½in. The centre portion of the bridge is stiffened by means of four cross girders, 3ft. 6in. deep, built up of web plates, ½in. thick and flange angles, 6in. by 6in. by ⅝in. Two of these girders, each placed 14ft. from the centre of the bridge, are rigidly connected to the circular girder along the longitudinal centre line of the bridge. The other two of these girders are placed 2ft. 6in. apart at the centre of the bridge. They carry the upper half of the centre pin, and take the inner ends of four radial girders, the outer ends of which are connected to the circular girder, as shown in the plan of the centre portion of the bridge given in the Supplement. Connecting these radial girders are cross bearers, which, as mentioned above, carry the inner ends of the two centre main girders.

Where the circular girder makes junction with the outside main girder, part of the top flange plate is carried right through the web of the main girders, and the lower flange plate is omitted. The web plates are bent so as to coincide with and fit snugly against the web plates of the main girders. In the angles where the web plate of the outer of the two circular girder web plates and the web plate of the outer girder come together, there are arranged special castings which entirely fill the angular space between the two sets of web plates and all the members forming joint are in each case bolted tightly together. This construction naturally has the effect of cutting off a portion of the circumference of the outer web of the circular girder, and to replace the portions taken away so as to complete the continuity of the circular girder, a plate curved to the same radius as the outer web plate of the circular girder is arranged outside the outside main girders, and riveted and bolted to the latter, castings similar in form to those used inside at the junction of the circular girder and the outside girders being employed. In place of the flange plates of the circular girder which were referred to above as being omitted, there is a specially-formed flange plate, 1in. thick, which embraces the unflanged parts of the circular girder and the outside main girders on both sides. The whole arrangement provides a neat and strong structure, and it forms one of the leading features of the bridge.

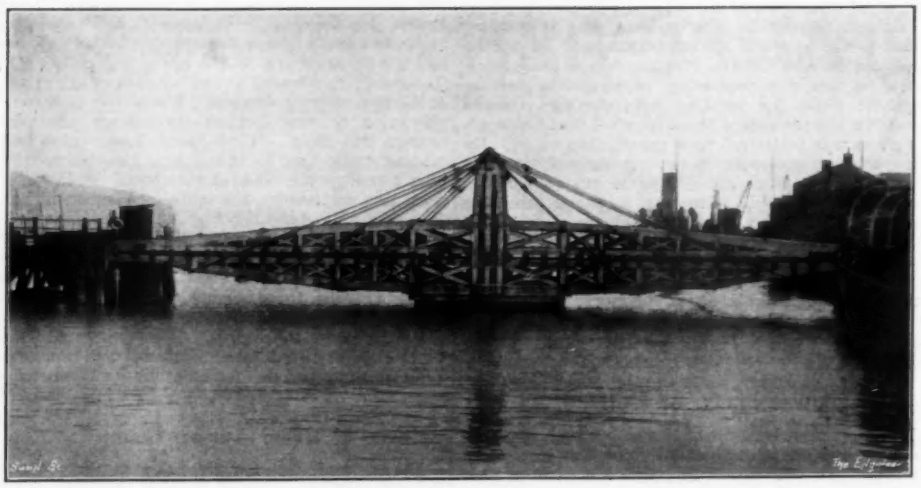


FIG. 2—THE OLD WOOD SWING BRIDGE

The ends of the outer and centre main girders are, at each end of the bridge, connected together by means of cross girders, a part plan of one of which may be seen in the plan of the bridge in the Supplement—Drawing No. IV.—and also in the drawing showing the

toggle mechanism, to which reference is made later. The outside plates of these cross girders are curved to a radius of 70ft. 1in., and their outer faces approach within about 1in. of the curved end walls of the two abutments. Diagonal stiffening bracings are applied to the undersides of the main longitudinal girders connecting them together. The rails are carried on longitudinal pitch pine sleepers, 140ft. long by 18in. wide and 7in. deep, which are supported on longitudinal joists which are themselves carried on cross girders arranged at 5ft. centres, these girders being riveted to the main longitudinal girders.

The bridge revolves on twenty-four cast steel taper rollers with larger and smaller diameters of $20^{27}/_{32}$in. and $19^{5}/_{32}$in. respectively, and measuring 11in. wide on the face. The lower and upper roller paths are both of cast steel, and have both the same face width as the rollers. The centre of each path is arranged at a radius of 12ft. The upper roller path is secured to the underside of the circular girder portion of the bridge, while the lower path is carried on a base track built up of iron castings, curved in plan to the correct radius. These track castings, of which there are twelve in the complete circle, are securely attached by angles arranged radially and bolted at their inner ends to a cast iron spider through which passes the central pin or shaft round which the bridge revolves. The rollers, which are at equal distances apart, are mounted on mild steel spindles which radiate from a strongly-braced central ring of cast steel, which itself also revolves on the central pin. Embracing the pin at the top is a casting which is secured to the underside of framework forming part of the central girders. The pin thus serves to locate the bridge in its correct position. Drawings showing the arrangement of the rollers and roller path are given in Drawing No. V. in the Supplement.

FIG. 3—THE NEW STEEL SWING BRIDGE—LOW TIDE

When the bridge is in service, its weight is taken partly on the rollers and partly on six bearing blocks—three at each end of the bridge—arranged immediately under the centres of the three main girders. These blocks, which are steel castings, are made to slide to and fro between upper and lower bearings, so that when it is necessary to open the bridge they can be withdrawn. In order to do that, however, it is necessary to take the weight of the bridge from off them. The lifting of the bridge is effected by means of an arrangement of toggles, of which there are four, two at each end of the bridge. We shall explain how the toggles are operated later; meanwhile, it may be said that the height through which the ends of the bridge structure is lifted is quite small, only about $\frac{1}{4}$in. It is sufficient, however, to free the bearing blocks so that they can be slid away from their seats. When they have been withdrawn and when the toggle mechanism has been operated to lower the bridge again, the whole of the weight is transferred to the rollers, and the bridge can be revolved. The bases for the toggles and for the bearing blocks are iron castings which are mounted on the masonry of the abutments. The upper thrust of the toggles is taken in each case by an arrangement of steel joists, the tops of which come just above the deck of the bridge.

The various operations necessary for freeing and refixing the bridge are effected by hand, the mechanism for doing so being placed on the floor of the bridge in the centre of the circular girder, and hence between the two lines of running rails. The arrangement of the various levers and the toggle operating winch is shown in Fig. 4. Normally, that is to say, when the bridge is in service for the passage of trains, the lever for operating the signal contacts and mechanical locks is in the position indicated by dotted lines. In that position it is locked and it can only be freed from the signal box on the station—or sea—side of the bridge. When it is desired to free the bridge, the first operation is to remove the fish plates from both sets of rails at each end of the bridge. Then the electrical lock on the bridge having been freed from the signal box, the lever controlling the signal contacts and mechanical locks can be pulled into the position shown in the drawing by full lines. That motion has three effects:—(*a*) It removes a lock which has up till then prevented the toggle winch being operated; (*b*) it opens a multi-leaf switch at each end of the bridge, the contacts of which are in the electrical circuits running from the station signal box; and (*c*) it removes a lock which has, up till then, prevented the movement of the larger lever, to the left in the drawing, by which the bearing blocks are withdrawn.

It is then possible to operate the toggle winch, which is done by four men with cranked handles. A drawing of the toggle mechanism is also given in our Supplement—Drawing No. VI.—from which the operation will be readily understood. The working of the winch causes the revolution of two shafts, one running from below the winch to each end of the bridge. Those shafts actuate, through gearing, two cross shafts, one at each end of the bridge, which, being screwed at their outer ends, produce sliding motions in the crossheads from which the toggles themselves are operated.

The operation of the toggle mechanism has, as already explained, raised the ends of the bridge slightly so that the weight of the structure is removed from the bearing blocks, which can then be withdrawn by means of the larger hand lever in the centre of the bridge. The movement of this lever in withdrawing the bearing blocks, at the same time raises gravity-controlled latches which locate the bridge in its correct position circumferentially, so that the rails on either side of the bridge align properly with those on the bridge itself.

The toggles having been released, the bridge is then free to move and it can be swung open by the aid of an electric capstan on the wharf. To effect the closure, the hauling rope from the capstan is attached to the other side of the bridge, and the latter is slowly pulled back into its normal or service position. The latch mechanism has, in the meantime, been freed so that the latch itself is again free to operate. As the bridge revolves, the bottom of the latch bolt encounters a camel back, formed by a casting set on the bedstone of the abutment, which it mounts. Just as the correct position of the bridge is reached, the latch reaches the downward slot in the camel back, drops in under its own weight, and holds the bridge in correct alignment for the subsequent operation of the toggles and the sliding bearing blocks.

The latch bolt mechanism is illustrated in Fig. 5. There is one of these locating latches at each end of the bridge.

The toggle winch is then again operated so as to raise the ends of the bridge in order that the bearing blocks may be returned to their normal positions, and when that has been done, the bridge may be lowered by the toggle mechanism so as to rest upon them. Thereafter, it is necessary to pull over the lever which closes the signal switches and locks the bearing block-operating lever and the toggle winch. Then, when the fish-plates have been replaced, the bridge is again in a condition for service.

As we have already explained, the replacement of the old by the new bridge was carried out during the week-end May 10th to 12th last. The operation was entirely successful, though the removal of the old bridge took rather longer than had been anticipated, owing to the fact that steel plates, the existence of

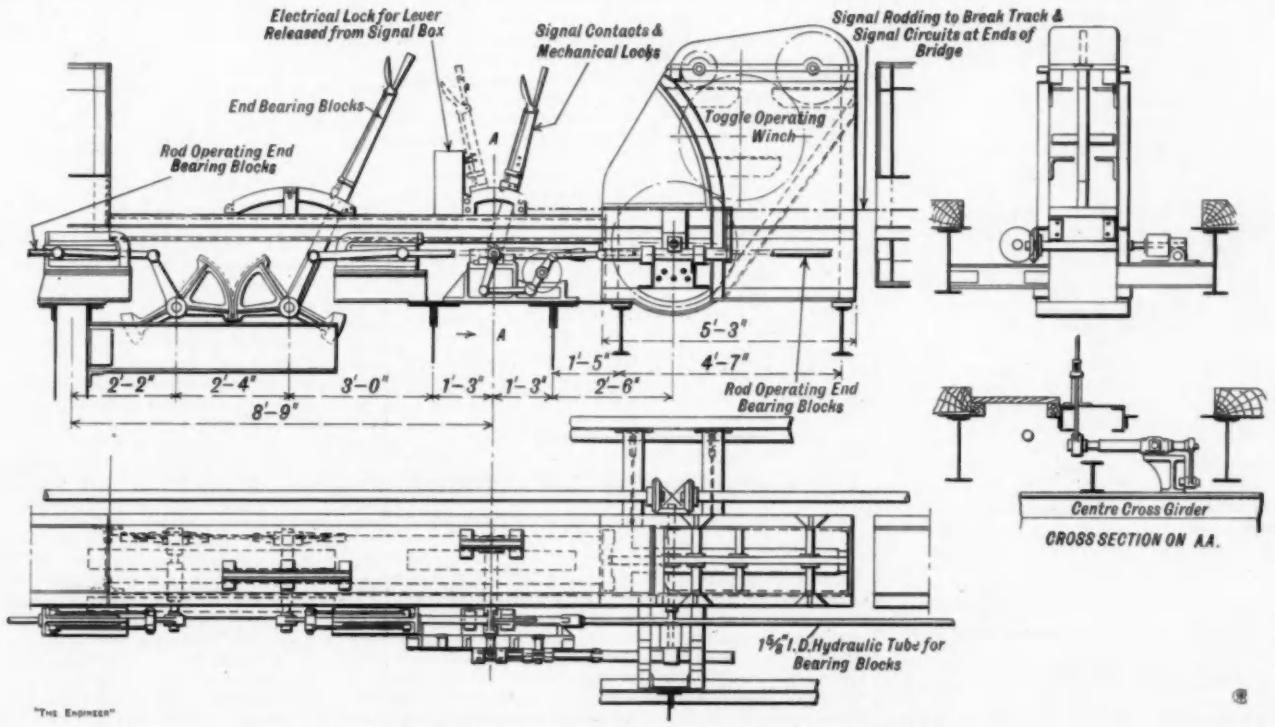



FIG. 4—MECHANISM-OPERATING LEVERS AND TOGGLE WINCH

which was unknown owing to their being embedded in the woodwork, were encountered. Otherwise, the operations proceeded exactly in accordance with schedule.

As much work as possible had previously been done in the way of trimming and preparing the masonry of the centre pier and of the abutments. Timber stagings carried on timber trestles had been constructed to the westward, or Inner Harbour, side of the bridge, and on them the whole of the girder work for the new bridge had been assembled and riveted up parallel with and close to the old timber bridge. Pre-cast concrete blocks, to form temporary supports, were placed on the centre pier, so that the new bridge

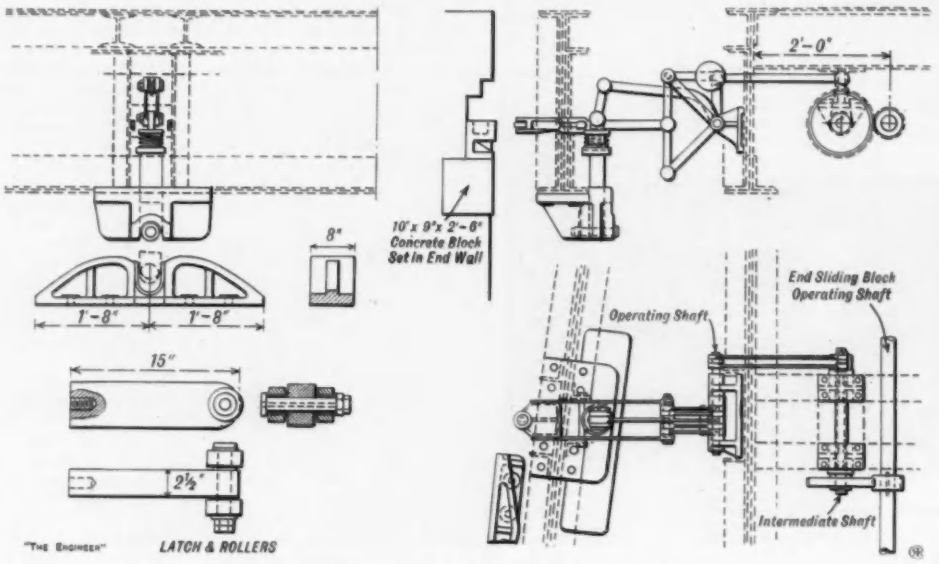



FIG. 5—ARRANGEMENT OF LATCH BOLT MECHANISM

might rest on them and be used temporarily as a fixed structure whilst the rollers and their races, and also the operating mechanisms were put in place. There were six of these temporary bearings—three on each side—on the centre pier—see Fig. 6—and they were arranged to come directly under the three main girders of the bridge. We may say in passing that the concrete pillars on the centre pier have been allowed to remain and can be seen in the view of the bridge given in Fig. 3.

The new bridge was lowered from the position in which it had been assembled on the stagings down on to trolleys running on tracks laid on the stagings and drawn across on them by winches until it was directly

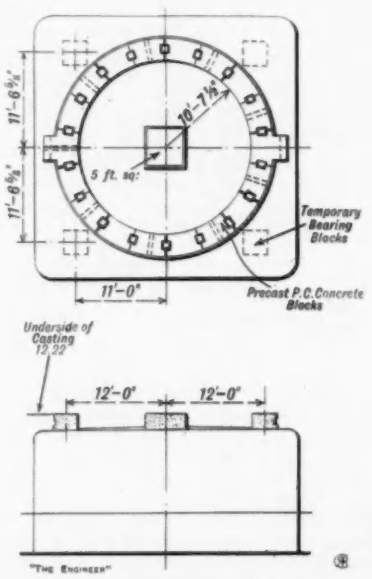



FIG. 6—THE CENTRE PIER

over the position which had been occupied by the old bridge. During the process of being drawn into position, the bridge was kept 6in. higher than its permanent level and was lowered by jacks through 4in., so as to rest on the temporary bearings at a level 2in. above its final position to allow the complete roller track to be placed while the bridge carried traffic as a fixed span. On completion of the roller track, the whole bridge was lowered the remaining 2in. on to the live ring of rollers.

Drawings showing the arrangements made to support the bridge on the centre pier are given in Fig. 6. After the levelling of the top of the pier had been completed, which, it will be remembered, was partially done before the old bridge was removed, a number of precast, specially-formed concrete blocks were got into position to form the support or foundation for the lower roller track. These blocks, which were bedded on cement, were so shaped that they formed a complete circle, 10ft. 7½in. in internal radius and with its centre at a radius of 12ft. They fitted closely together and in their abutting faces were formed corresponding rectangular recesses for bonding the blocks together. When the blocks were in their correct positions, rectangular blocks of concrete were dropped and cemented into the spaces thus left, with the result that what was practically a solid ring of concrete cemented to the top surface of the pier was constituted. The two blocks which had acted as temporary supports for the centre girders when the bridge was worked as a fixed structure were utilised to form part of the ring. At the centre of the ring there is a pier of concrete 5ft. square, to form the foundation for the central pin on which the bridge revolves. At various points round the ring, channels were formed on the underside of the blocks to drain away any sea or rain water which, when the bridge is in service, may enter the chamber formed by the ring.

On the occasion of our inspection, we were enabled thoroughly to examine the new bridge, both at deck level and from below. We also descended through a trap door into the chamber formed by the concrete ring foundation and the interior of the circular girder. While there, several engines and a couple of trains passed overhead, and the smallness of the vibrations set up by those moving loads was particularly noticeable. Indeed, we were particularly struck by the strength of the whole structure and the excellence of the workmanship.

In conclusion, we desire to express our thanks to Mr. Ellson for permission to visit and describe this interesting bridge, and for furnishing us with the drawings which we have reproduced. Our thanks are also due to the various members of his staff with whom we came in contact for the valuable assistance which they afforded us both before this article was written and during its preparation.

The contractor for the construction and erection of the new bridge and the dismantling and demolition of the old bridge was the Horseley Bridge and Engineering Company, Ltd., of Birmingham and London.

## The Early Days of Gas Lighting.

By P. G. CRACROFT, City of Hull Water and Gas Undertakings.

No. I.

ANY review of the early days of gas lighting would be incomplete if it did not contain a general reference to the science of chemistry, and to some of the outstanding figures who have contributed notable achievements for the progress of the world, and whose discoveries resulted in lasting benefit to the gas industry. Space will not permit mention of all the great personalities who have made important discoveries of world-wide concern. A few only can be named, before passing to a digest of the events which record the discovery, adoption, and practice of lighting by gas.

Paracelsus, a celebrated empiric and alchemist in the sixteenth century, first proposed the production of carbonic acid gas from lime by the action of acid, and enriched chemistry with some valuable discoveries. The first recorded instance of producing and storing a gas, is that given by the Hon. Robert Boyle, born in 1626, a renowned natural philosopher and chemist, who was the seventh son of Richard, Earl of Cork. Boyle had an ample fortune, and has described one of his experiments in which a number of iron nails were placed in dilute acid, when a quantity of "air" was evolved. This he considered to be atmospheric air, produced artificially, but it was subsequently ascertained to be hydrogen gas. The word "gas" was introduced by Jan Baptiste van Helmont, who was born in 1577. In an experiment, he burnt 71 lb. of charcoal, which yielded only 1 lb. of ashes, and he concluded that the other 70 lb. formed the "spirit." "This spirit," he said, "up to the present time unknown, not susceptible of being confined in vessels, nor capable of being reduced to a visible body, I call by the new name of 'gas.'" An important discovery was that made by Dr. Joseph Black, who, in 1755, produced carbonic acid gas, and designated it "fixed air." The doctor, who was a Professor of Anatomy and Chemistry at Glasgow and, later, a Professor of Chemistry at Edinburgh University, was also the author of the theory of "latent heat." Perhaps one of the greatest of Frenchmen, Antoine Laurent Lavoisier, rendered eminent services to his profession. His great fame rests upon his many discoveries in chemistry, which completely overthrew the then accepted phlogiston theory, and established the modern theory. He also invented the gasholder, as mentioned later. Tragic was the termination of his career, for he fell a victim to the guillotine during the Revolution in 1794. One of the greatest epochs in the progress of chemistry was founded by the investigations on carbonic acid gas, on hydrogen, nitrogen and oxygen by Henry Cavendish, who was the son of Lord Charles Cavendish. He discovered water to be composed of hydrogen and oxygen, and may be described as the "Newton of chemistry." Another important discovery was that of oxygen, made by Dr. Priestley, in 1774; his "Observations on Different Kinds of Air" had gained him the Copley medal two years previously. He found congenial spirits in Boulton and Watt, both of whom were intimately concerned with gas lighting. A prominent Swedish chemist, Karl Wilhelm Scheele, was responsible for many discoveries, among which are nitrogen and chlorine.

Although the discovery in this country of lighting by gas was only made in the latter part of the seventeenth century, the Chinese had, for ages, been well acquainted with the use of gas for that purpose, and were probably the first nation to possess the knowledge. They employed spontaneous jets of gas for lighting and other economical purposes. The supply was obtained by boring into coal beds, the gas being forced up in jets 20ft. to 30ft. high, and then conveyed in tubes for lighting streets and large houses. They also employed fire springs, "Ho-tsing," which were sunk to obtain a carburetted hydrogen gas for salt boiling. These were far greater in depth than our artesian wells, often being more than 2000ft. deep; one spring of continuous flow was found to be 3197ft. in depth. This natural gas has been used in the Chinese province of Tse-schuan from time immemorial, while "portable gas," in bamboo canes, has for centuries been used in the city of Khiung-tacheu.

The crudest form of gas lighting is probably seen in the alternate bursting-out and extinction of pitchy vapour in a coal fire. From that state to the gas lighting of modern times is a far cry, and the evolution of gas manufacture is indeed a romance which it is not proposed to attempt to include in the scope of this short article.

The history of the early development of gas might be conveniently placed in three categories, each marking a distinct step in the progress of this form of lighting. The first example of lighting by gas in this country was furnished by the experience of Thomas Shirley in 1659, when he visited the neighbourhood of Wigan in order to investigate the statements of the people that the water of a certain spring burned like oil. He applied a light near the spring and an outburst of flame was the result. He came to the conclusion that "bituminous or sulphurous fumes" from coal was the explanation of this phenomenon, and, constructing a dam to retard the flow of water, he lit the gas spring and obtained a flame about 18in. high. This experiment showed that gas could be obtained from coal, but Shirley did not attempt anything further, leaving the next step of finding a method of extracting the gas from the coal to later investigation. The account of Shirley's experiment is contained in the "Philosophical Transactions" of 1667, and is entitled "A Description of a Well and Earth in Lancashire Taking Fire by a Candle Approached to it."

The first use of coal gas was as an illuminant, burning without any previous admixture of air with a yellowish luminous flame, and the earliest observation and demonstration of this property is ascribed to the Rev. John Clayton. His uncle, Thomas, held lands near Wigan, and, about 1684, Clayton had his attention called to the gas spring near that town, which, in all probability, was the same spring as that visited by Shirley twenty-five years before. The volume was by then much reduced, and the result of the doctor's subsequent investigations and experiments arising out of his experiences at the burning spring are contained in the "Philosophical Transactions" for 1739–40, Vol. XLI., pages 59–61. The notes were sent to the Royal Society by Dr. Robert Clayton, then Bishop of Cork, who copied them from his father's original papers.

Describing the events at the Wigan "ditch," as the reverend gentleman called it, he remarks that the people said that water seemed to burn like brandy, that the flame was so fierce that eggs had been boiled over it, and that, thirty years before, it would have

boiled a piece of beef. Clayton, however, found that, although a lighted paper was waved all over the "ditch," no flame was obtainable. Then he had the water drained off to see if a flame could be produced from the steam which arose. This had a negative result, but on a hole being dug about 18in. deeper a shelly coal was found. A candle was then placed in the hole and a flame resulted.

Clayton then noticed the proximity of disused coal pits and suspected a relationship between the old pits and the "ditch." Accordingly, he obtained some coal from one of the pits and began investigations on a line which, had the results been followed up at the time, would probably have given us gas lighting a hundred years before it did, although there would undoubtedly have been a difficulty in devising the necessary machinery, as the inventions of Watt, Murdoch, Newcomen, Savery and others were still to come. Clayton distilled some of the coal in a retort in an open fire and thus obtained phlegm, black oil and a spirit. This "Spirit of Coal," as he named it, he put into bladders, to save it and, in order to amuse his friends, he was wont to prick holes in the bladders and light the gas as it escaped. In carrying out this part of his experiment Clayton used a turbinated receiver, the gas ascending into the bladders and the phlegm and black oil descending into the receiver. He also made the discovery that gas retained its inflammability after being passed through water, by which means, of course, the phlegm became water, the black oil coal tar, and the spirit gas. Clayton's discoveries marked a great advance on Shirley's experiment; they demonstrated that tar and gas could be obtained by heating coal, that the gas would yield light, that it was insoluble and could be collected and stored for future use.

After these experiments another instance of a gas spring was reported, but nothing of a practical nature towards utilising the spirit on a general scale was attempted. In 1733, in the "Transactions" of the Royal Society, is to be found a communication from Sir James Lowther, describing a spontaneous combustion of gas at a colliery belonging to him near Whitehaven; air rushed up, which caught fire at the approach of a light and burned with a flame 6ft. high and 3ft. in diameter. A tube was inserted and, on being lit, the gas burnt for nearly three years, without any sign of decrease, and lighting up the surrounding country. The gas was taken away in bladders, fitted with small pipes, and used when required by the workmen and others.

About 1767, another clergyman made a similar experiment to that carried out by Clayton. Dr. Watson, Bishop of Llandaff, distilled coal, passed the resulting gas through water and conveyed it away through pipes. He was a Professor of Chemistry, but does not appear to have made any practical use of his experiments. This seeming inability to visualise the more commercial aspects of a discovery is not confined to any one profession, for there are numerous instances on record of inventors in various walks of life failing to gather to themselves the fruits of their ingenuity. Another experimenter was Jan Pierre Minckelers, a Professor at Louvain University, who, in 1784, distilled many substances, including coal, and, in 1785–6, lighted his lecture room with gas.

One hundred and fifty years ago the Metropolis was so badly lighted and watched that the Lord Mayor and Aldermen went to the King with a petition stating the City to be so infested by gangs of highwaymen that it was dangerous to go out after dusk. Before the doors of a few old houses in London could be seen, a few years ago, on each side of the lamp-iron, a large extinguisher, in shape like the old postboy's horn, into which the flambeaux or links were thrust, after the inmates of the house had been lighted home. Oil lamps were then introduced about 1762, and the lamplighters of those days were equipped with ladder, oil can and supplies of oil, cotton wicks, and flaring torch to light the lamps. The great Dr. Samuel Johnson, when living in Bolt-court, Fleet-street, where he died, is said to have had a prevision of the change from oil lighting to gas lighting. He noticed the parish lamplighter ascend his ladder to light one of the oil lamps; he had scarcely descended the ladder halfway when the flame expired. The lamplighter returned, lifted the cover of the lamp partially, and thrusting the end of his torch beneath it, the flame was instantly communicated to the wick by the thick vapour which issued from it. Whereupon the doctor is said to have exclaimed that "one of these days the streets of London will be lighted *by smoke*."

In the year 1792 occurred an epoch-making event of great interest to the gas industry. William Murdoch, in the course of experiments made at Redruth, Cornwall, produced gas by distillation of coal, peat, wood, and other inflammable substances. His apparatus consisted of an iron retort with tinned iron and copper tubes, through which the gas was conducted and burnt at apertures of various forms and dimensions. He used coal of different qualities and instituted several experiments with a view of ascertaining the cost at which the gas might be obtained, compared with that of equal quantities of light yielded by oils and tallow. He washed the gas with water and other means were employed to purify it.

Up to this point the labours of Clayton and Murdoch were on almost identical lines. But whereas the former's experiments were concerned with the distillation of coal only, those of Murdoch included the distillation of other substances also, and the question of the comparative costs of different methods of lighting, to ascertain how far the new illuminant would be likely to be more economical in use. He went further and lit his house and offices, the first in the world to be lighted by the new means. He also made a gas lantern with a jet at the bottom and a bladder of gas underneath, and with this contrivance he provided himself with a ready means of finding his way home at night across the moors of Redruth.

Murdoch was not, however, content to leave his work at this point, and in 1794 he endeavoured to get Watt, the great engineer, and in whose employ he was, to take out a patent, as he had satisfied himself of the superior economy, safety and illuminating qualities of coal gas. Nothing, however, was done to protect Murdoch's interests, Watt being fully engaged in litigation concerning his steam engine. Nothing daunted, Murdoch, in 1798, continued his investigations, contriving an apparatus for making, purifying, and storing a large quantity of the gas. Several of the offices in Boulton and Watt's building at Soho, Birmingham, were regularly lighted by its means, and in 1802 the first demonstration on a large scale was made, when Murdoch brilliantly illuminated the front of the works at Soho, in celebration of the Peace of Amiens. Prior to this, in 1801, a certain Monsieur Phillipe Lebon had proposed a plan for lighting with gas some of the streets of Paris, and had also, in 1799, patented the "thermo lampe," a self-contained apparatus for the production of gas from wood, coal, and other similar solids.

The new light was a great success, and Boulton and Watt then authorised Murdoch to equip the manufactory with pipes and burners. From that time it continued to be regularly lit with coal gas, and the example was followed by other large firms. Boulton and Watt went further, for they decided to manufacture gas apparatus and, under Murdoch's direction, they expended £5000 on equipment for the purpose. In 1804 the firm fitted up the factory of Phillips and Lee, of Manchester, and in the following year Murdoch described the method adopted in a paper which was published in the "Philosophical Transactions" for 1808. This account was communicated to the Royal Society, which awarded Murdoch Count Rumford's gold medal.

After Lebon had made his proposal to light the streets of Paris with gas he had his house illuminated with the new light, obtained from wood and coal. At that period a German, of the name of Winsor, being at Brunswick, saw an account concerning the manufacture of Lebon's gas, which had been read before the French Institute. He translated the communication into German and English, and then commenced a long campaign with the object of demonstrating the economical advantages of gas and forming a company for its manufacture. In the course of his efforts it appears that he had carried out a series of experiments in making gas by distilling wood, &c., before the Duke Regent and his Court. In 1802 he came to England, and in January, 1804, lit the Lyceum Theatre in London. He continued his campaign with vigour, delivering lectures on the subject which he illustrated by many experiments. It was some years later, however, before his activities came to fruition.

In the meantime Samuel Clegg, who began as a pupil with Boulton and Watt and who, in later years, accomplished much towards the development of the gas industry, was already devoting all his energies to the mechanical appliances connected with the successful application of gas. He was also engaged in the erection of private gasworks at cotton mills and other establishments, and in 1807 and 1808 completed the installations at several mills, prior to which, in 1806, he exhibited lights in front of his factory. The success of gas in cotton mills was not only the clearness and intensity of the light, but it was free from the danger and inconvenience of "snuffing," which candles occasioned. In 1809 Clegg described to the Society of Arts his apparatus for lighting the mills, for which he received a silver medal.

Winsor now began to be more active, and in 1807 he illuminated the wall between Pall Mall and St. James's Park, also the Golden-lane Brewery. In the same year part of Whitecross-street and Beech-street, Barbican, were experimentally lighted with gas. Winsor then occupied extensive premises in Pall Mall, where he demonstrated the practical utility of gas for lighting, heating and cooking; and it was from those premises that the gas pipe was laid, with lamp posts at short intervals. Pall Mall was the first public street ever lighted by gas, and it remained lit during the parliamentary sessions of 1809 and 1810, while Winsor was endeavouring to obtain an Act of Incorporation and Charter. The capital necessary to carry out the experiments and work preliminary to the formation of a company was raised by subscribers, the amount being stated at £20,000 and £50,000. A memorial was presented to the Chancellor of the Exchequer, who sent it to the Privy Council, which remitted it to the King, who, like the Council, did not wish to move in the matter. He therefore returned it to the Privy Council, which sent it, this time, to the Attorney-General. He decided that his Majesty could not grant the Charter of Incorporation until a Bill had been obtained from Parliament authorising the formation of a company.

Winsor's application to Parliament for a Royal Charter with extensive privileges, included powers to form a joint stock company to light part of London and Westminster with gas, and was made in 1809. The profits were to be prodigious. He issued a pamphlet entitled "The New Patriotic Imperial and National Light and Heat Company," from which it appeared that the net annual profits, "agreeable to the official experiments," would amount to over £229,000,000! and that, giving over nine-tenths of that sum to the redemption of the National Debt, there would still remain a total profit of £570 to be paid to the subscribers for every £5 of deposit! Such a result would make present-day shareholders of modern undertakings immensely displeased with their meagre dividends of 4 and 5 per cent.

*(To be continued.)*

# The Heating and Drying of Granular Materials by Convection.

By W. GILBERT, Wh. Sc., M. Inst. C.E.

No. V.*

[A DRAUGHTSMAN'S error occurs in the graph W reproduced as Fig. 23 in our last issue. The correct graph is given below. The average lump sizes of

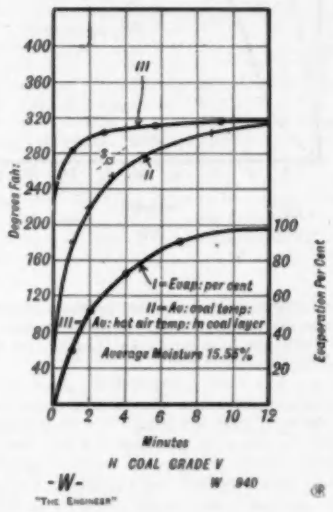



FIG. 23 (CORRECTED)

coal—Fig. 21—were full size, not half size as stated under the block.—ED. THE E.]

## APPLICATION OF THE MATHEMATICAL THEORY OF HEAT CONDUCTION TO DRYING PROBLEMS.

Considerable assistance as regards drying problems may be obtained by a study of the Mathematical Theory of Heat Conduction which can be found, for instance, in the text-book by Ingersoll and Zobel. The Fourier Equation of Heat Conduction is there explained.

Most of the text-book investigations relate to the distribution of temperature which will occur, in bodies of various shapes, after a definite period of heating.

The method by which heat is supplied to the body is not taken into account, a simple and uniform source of heat supply being assumed. The fourth power radiation law, for instance, was developed subsequently to the work of Fourier.

The graph A *d* illustrates the Fourier method as applied to the heating of a cube of 1in. side. The initial particulars on which the calculations are based are:—

(1) The temperature of the hot air stream in which the cube is immersed. The initial temperature of the cube is assumed to be zero, and it is convenient to take the hot air temperature, which is also the final cube temperature, as 100 deg. higher. The actual hot air temperature is readily allowed for when required.

(2) $H_c$, as previously defined, is the rate of heat supply by convection in B.Th.U. per square foot per hour, per degree Fahrenheit, temperature difference.

(3) K is the conductivity of the material in B.Th.U. per square foot per hour per degree Fahrenheit per inch thick.

(4) $\rho$ is the density of the material in pounds per cubic foot.

(5) $\varphi$ is the specific heat of the material.

A mathematical expression is obtained consisting of a series of terms, which will give the temperature at any point of the cube after any period of heating *t* in minutes. In this instance the Fourier Equation is used to obtain on graph A *d* the average temperature of the cube, Curve II., the average surface temperature of any face, Curve I., and the temperature at the centre of the cube, Curve III.

The results are not quite accurate when $t = o$, but the errors rapidly vanish as *t* increases.

* No. IV. appeared November 28th.

Graph A *e*, which also relates to a 1in. cube, shows the effect of reducing $H_c$ by one half, the remaining conditions being the same as before.

Heat being now supplied to the cube at a slower rate, the vertical distance between the surface temperature curve and the average temperature curve is diminished, leading to a better value for the temperature difference between the hot air and the surface of the cube. For instance, dividing $H_c$ by two, only increases the time required for the average temperature of the cube to reach 90 per cent. of the final value from 8·4 to 11·8 minutes.

Graph A *f*—Fig. 26—shows the effect of increasing the conductivity from 1·5 to 9·0, the remaining conditions being as for graph A *d*. Compared with the latter, the time required for the average temperature of the cube to reach 90 per cent. is reduced from 8·4 to 4·1 minutes, owing to the better temperature difference obtained.

Graph A *g* has been prepared to show the effect of a large increase in the size of the cube, which is taken to have a side of 48in. The remaining conditions are the same as for graph A *d*. The surface temperature curve, marked I on the graph, rises immediately to a very high value, and the temperature difference available for heat supply to the cube consequently becomes very small. After a heating period of 15,000 minutes, the average temperature of the cube is 93 per cent. of the maximum, and the temperature difference between the hot air and the surface of the cube is only 0·071 of a degree. After 2000 minutes of heating the temperature difference is 0·95 of a degree.

Graph A *h*—Fig. 27—shows the heating of a rectangular brick of material, 9in. by 4½in. by 3in., the value of $H_c$ being 6·0. The average surface temperature on each face of the brick has been worked out and plotted. It will be noted that the available temperature difference for heat supply is small.

The time required to work out a graph like A *h* with the four curves, on the Fourier system, is from four to five days.

The Fourier Equation brings out the fact that the actual temperature difference assumed between the hot air supply and the initial temperature of the brick, or cube, is not material. If the hot air temperature is taken at 200 deg. Fah. in excess instead of 100 deg. Fah., the average temperature would rise to 90 per cent. of the maximum temperature in the same time as before; and the temperature at any part of the block would have twice its previous value.

### Approximate Method of Calculating Heating Curves.

The graphs show the wide range of useful information which can be obtained by the use of the Fourier method. As applied to practical problems, there are limitations, such as :—

(*a*) It appears to be necessary for mathematical simplicity to assume that the rate of heat supply is directly proportional to the temperature difference between the hot air and the surface temperature of the material. Hence the fourth power radiation law can only be approximately applied.

(*b*) For the same reason it appears to be necessary to assume that the heat is supplied at a constant temperature, but in practice obviously it may vary considerably. For example, the gas temperature inside a rotary kiln, which is available for heating the material lumps, will range from 2500 deg. to 700 deg. Fah., or similar figures.

The question therefore arises as to whether some approximation, based on the Fourier method, can be used which will be sufficiently accurate for the present purpose of finding out how quickly material lumps of various sizes and shapes may be dried or heated. It is usually desired to calculate the average temperature of the lump when near to the end of the period of heating. From the average temperature the surface temperature may be deduced. It is not necessary for the approximate calculation of drying problems, to know the temperature distribution at any point throughout the lump.

*Application to Cubical Block.*—Taking, for instance, the heating experiment on a 1in. cube as represented by the Fourier graph A *d*, the cube is replaced for calculation purposes by the two plates A and B, shown in cross section in Fig. 28.

(1) The area of the face C D of the plate A is equal to the surface area of the cube.

(2) The conductivity of plate A is the same as that of the original cube, but its specific heat is 0.

(3) The thickness of plate A is denoted by $\bar{x}$.

(4) Plate B has the same weight, and specific heat, as the original cube, but its conductivity is infinitely great, so that all parts have the same temperature at any time. Heat is supplied to the face C D, using the same values for the hot air temperature, and $H_c$, as in the original experiment. If the distance $\bar{x}$ can be suitably chosen, the temperature of the face C D will be the same as the surface temperature of the cube, and the temperature of the face E F will be the same as the average temperature of the cube, throughout the heating experiment. Assuming $\bar{x}$ to have a constant value, it is easy to prove that the temperature rise of the block B, after a heating period of $t$ minutes, will be given by the following expression :

$$R = 100\,(1 - e^{-St}) \quad . \quad . \quad . \quad . \quad . \quad (4)$$

where R = rise of coal average temperature per cent.
$e$ = base of Naperian logarithms.
S = surface of cube, or block in square feet per pound.
$\varphi$ = specific heat of material,

and

$$Z = \frac{S}{60\,\varphi\left(\frac{1}{H_c} + \frac{\bar{x}}{K}\right)} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

The formula is accurate, provided that a suitable value is chosen for $\bar{x}$, the thickness of the screen plate. It is also applicable to the heating of rectangular blocks and spheres. It is found by an examination of several Fourier graphs that a value of $\bar{x}$ equal to one-sixth of the side, in inches, is suitable for cubes of any size when the temperature rise—as calculated by formula (4)—is in the neighbourhood of 95 per cent. If the temperature rise is less than 95 per cent., values of $\bar{x}$ may be obtained from Table XI., which will be described later.

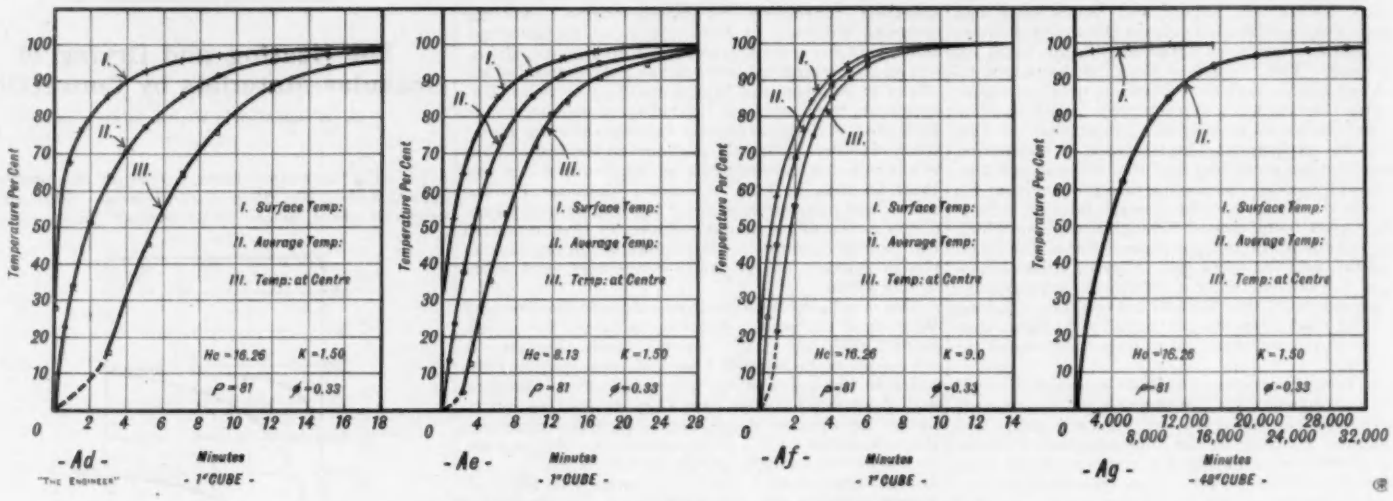



FIG. 26—GRAPHS ILLUSTRATING THE FOURIER METHOD

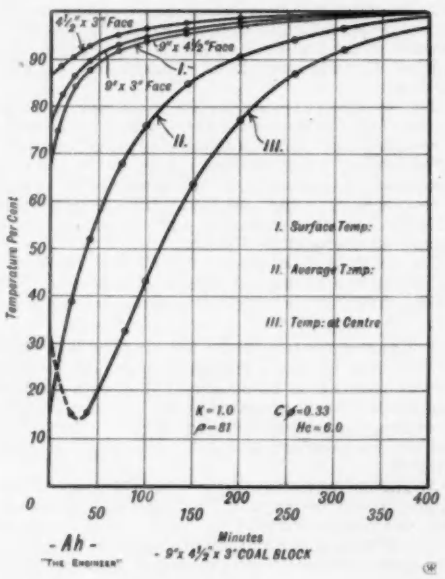



FIG. 27

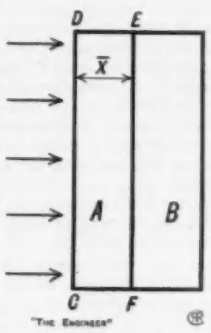



FIG. 28

Table XI.—*Overall Values of* $\bar{x}$.

| Dimensions of block. | Graph reference. | $\bar{x}$ calculated value, inches. | Ratio to calculated values in Col. (3) as obtained from the Fourier graphs. Temperature rise per cent = R. 70 | 80. | 90. | 95. | 98. |
|---|---|---|---|---|---|---|---|
| 1in. cube | A *d* | 0·167 | 0·762 | 0·846 | 0·930 | 0·978 | 1·020 |
| " | A *e* | 0·167 | 0·825 | 0·891 | 0·954 | 0·995 | 1·030 |
| " | A *f* | 0·167 | 0·943 | 0·963 | 1·000 | 1·025 | 1·030 |
| ½in. cube | — | 0·042 | 0·920 | 0·963 | 1·000 | 1·020 | 1·030 |
| 1/20in. cube | — | 0·008 | 0·910 | 0·960 | 0·995 | 1·010 | 1·020 |
| 48in. cube | A *g* | 8·000 | 0·910 | 0·930 | 0·960 | 0·996 | 1·010 |
| Rect. block, 1·03in. by 0·61in. by 0·44in. | — | 0·093 | 0·860 | 0·920 | 0·980 | 1·020 | 1·050 |
| Rect. block, 9in. by 4½in. by 3in. | A *h* | 0·643 | 0·750 | 0·841 | 0·945 | 0·990 | 1·040 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |

Formula (4) may be put into the form :

$$t = \frac{2\cdot3}{Z}\log.\left(\frac{100}{100-R}\right) . \quad (6)$$

S—the surface area in square feet per pound—will be found to be 0·889, and $\bar{x}$ is taken at one-sixth of the side in inches.

We have from (5)—

$$Z = \frac{0\cdot889}{60\times0\cdot33\left(\frac{1}{16\cdot26} + \frac{0\cdot1667}{1\cdot5}\right)} = 0\cdot26$$

and $t$ from (6)—

$$= \frac{2\cdot3}{0\cdot26}\log.\left(\frac{100}{4\cdot30}\right)$$

$$\therefore\ t = \frac{2\cdot3\times1\cdot3675}{0\cdot26} = 12\cdot1 \text{ minutes.}$$

We may next apply the formula to graph A *g*, which relates to a cube of 48in. side. Suppose it is required to find $t$, for a cube average temperature rise of 95 per cent. The value of $\bar{x}$ is taken as $\frac{48}{6} = 8$in., and S = 3/192.

Z from (5)—

$$= \frac{3}{162\times60\times0\cdot33\left(\frac{1}{16\cdot26}+\frac{8}{1\cdot5}\right)}$$

$$\therefore\ Z = \frac{3}{162\times60\times0\cdot33\times5\cdot395} = 0\cdot0001734$$

and $t$ from (6)—

$$= \frac{2\cdot3}{0\cdot0001734}\log.\left(\frac{100}{5}\right)$$

hence $t = 17{,}260$

The value taken from the graph is 17,200 minutes.

*Application of the $\bar{x}$ Formula to Rectangular Blocks.*—The value of $\bar{x}$ for a rectangular block may be obtained by dividing the block into six pyramids, and taking $\bar{x}$ for each pyramid, as one-third of the height. An average value of $\bar{x}$ for the whole block can then be obtained. If the sides of the block are $a$, $b$ and $c$, it follows that

$$\bar{x} = \frac{a\,b+a\,c+b\,c}{6\left(\frac{a\,b}{c}+\frac{a\,c}{b}+\frac{b\,c}{a}\right)}. \quad . \quad . \quad . \quad . \quad (7)$$

Suppose the formula to be applied to the 9in. by 4½in. by 3in. coal block shown on graph A $h$.

The value of $\bar{x}$ is

$$\frac{(9\times4\tfrac{1}{2})+(9\times3)+(4\tfrac{1}{2}\times3)}{6\left(\frac{9\times4\frac{1}{2}}{3}+\frac{9\times3}{4\frac{1}{2}}+\frac{4\frac{1}{2}\times3}{9}\right)} = \frac{81}{6\times21} = 0\cdot643\text{in.}$$

From the data given on the graph, S (the surface area of the block in square feet per pound) = 0·1975. Let it be required to find the heating period $t$, for a rise of the average coal temperature of 96 per cent.

Z from (5)

$$= \frac{0\cdot1975}{60\times0\cdot33\left(\frac{1}{6\cdot0}+\frac{0\cdot643}{1\cdot0}\right)} = 0\cdot0123$$

and $t$ from (6)—

$$= \frac{2\cdot3}{0\cdot0123}\log.\left(\frac{100}{100-96}\right)$$

$$\therefore\ t = \frac{2\cdot3\times1\cdot3979}{0\cdot0123} = 261 \text{ minutes.}$$

Here, again, the agreement is quite close, the time shown by the graph being 260 minutes.

Referring to Table XI., which gives the results of an examination of eight Fourier graphs, the calculated value of $\bar{x}$ in each case is given in Col. (3). In Cols. (4) to (8) various ratios of the actual values to the calculated values are given. For instance, Col. (4) gives a multiplier for the calculated value of $\bar{x}$ in Col. (3) which is to be used when the rise of average temperature is 70 per cent.

It will be seen that when the average temperature rise is from 90 to 98 per cent., the values of $\bar{x}$ differ little from the calculated values, and it is over this range that calculations are usually required in practice.

For instance, Col. (7) shows that for the six cubes listed when R = 95 per cent., the value of $\bar{x}$ does not vary more than 2 or 3 per cent., and the same remark applies to the two rectangular blocks.

It will be seen later that the $\bar{x}$ formula can assist in the solution of a large number of heating or cooling problems in practice.

Table XI. gives a list of all the Fourier graphs which have so far been analysed for values of $\bar{x}$.

*Application of the $\bar{x}$ Formula to Coal Drying in Layers, for Finding* $H_e$—Returning to the experiments made on the drying of coal in 1in. layers, in order to apply the results to practical problems, the value of $H_e$ must be known in each case. It was not feasible to determine such values by replacing the coal lumps by equivalent copper blocks—as was done in the case of the fully exposed experiments—on account of the large number which would have been required.

It was found possible, however, to obtain the requisite values of $H_e$ by the aid of the $\bar{x}$ formula. As an example, we may take graph W, which relates to the drying of grade V. coal at W = 940, and calculate the average value of $H_e$ over the period 0 to 4 minutes.

Referring to Table X., page 588, it will be seen that up to 4 minutes the total heat supplied per 100 lb. of wet coal was 20,168 B.Th.U.

The average temperature of the coal rose from 60 deg. to 266 deg., or 206 deg. Fah. The dry coal per 100 lb. is 84·45 lb.—refer Table IX., page 588—hence the equivalent specific heat is

$$\frac{20{,}168}{84\cdot45\times206} = 1\cdot16$$

It is found sufficiently accurate to treat the heat supplied to evaporate the moisture as an increase in the specific heat.

When calculating the Fourier graphs, the cubes and rectangular blocks were assumed to be immersed in an air stream at constant temperature, but in the case of layer drying the temperature fall of the hot air used has to be taken into account.

It can be proved that for 1 lb. of dry material the expression for Z to be used in formula (4) then becomes

$$Z = \frac{1}{\varphi\left(\frac{60}{H_e\times S}+\frac{60\,x}{K\times S}+\frac{1}{2\,M}\right)} \quad . \quad . \quad (8)$$

where M = the weight of hot air supplied per minute per pound of dry material, multiplied by the specific heat of the hot air.

In this case

$$M = \frac{442\times0\cdot24}{84\cdot45} = 1\cdot26$$

The figure 442 was obtained when working out Col. (12) of Table X.

To obtain $H_e$ from the average temperature curve on graph W for the period 0–4 minutes, Z is first calculated from R, the rise of average temperature per cent. The total temperature rise is 320 deg. − 60 deg. = 260 deg. At 4 minutes the average temperature of the coal has risen from 60 deg. to 266 deg. or 206 deg. Fah. Hence

$$R = \frac{206\times100}{260} = 79\cdot2 \text{ per cent.}$$

Hence from (6)—

$$Z = \frac{2\cdot3}{t}\log.\left(\frac{100}{100-R}\right) = \frac{2\cdot3}{4}\times0\cdot6819 = 0\cdot392$$

To obtain $H_e$ we transpose the formula (8) thus—

$$H_e = \frac{60}{S}\times\frac{1}{\left(\frac{1}{Z\,\varphi}-\frac{60\,x}{K\,S}-\frac{1}{2\,M}\right)} \quad . \quad . \quad . \quad (9)$$

It should be noted that formula (8) is used to calculate Z, and subsequently the rise of average temperature after any time $t$ by formula (4), the value of $H_e$ being known, but the graph not drawn.

Formula (9) is used to deduce the value of $H_e$ from Z, after the latter has been obtained from a point on the average temperature curve of the graph—already drawn—by means of formula (6).

The lump size of grade V. coal is 0·665in. × 0·356in. × 0·233in., the value of $\bar{x}$ can be calculated by formula (7) or taken from Table IX. From Table XI. the multiplier for R = 79·2 per cent. is seen to be approximately 0·90; hence the figure to use is 0·90 × 0·0501 = 0·0461. K is taken at 1·42.

The value of S, for grade V. coal, as given in Table IX., is 2·62. Putting the numerical values into formula (9), we obtain :—

$$H_e = \frac{60}{2\cdot62}\,\frac{1}{\left(\frac{1}{0\cdot392\times1\cdot16}-\frac{60\times0\cdot0461}{1\cdot42\times2\cdot62}-\frac{1}{2\cdot52}\right)}$$

$$\therefore\ H_e = \frac{60}{2\cdot62}\,\frac{1}{(2\cdot20-0\cdot745-0\cdot397)} = 21\cdot60$$

The calculated values of $H_e$ for all the layer drying experiments are given in Col. (6), Table IX. The value 22·3, given for grade V. coal, is an average obtained by working out from the graph average values of $H_e$ over the periods 0–4, 0–7, and 0–9 minutes respectively.

A value for the conductivity K of 1·42 has been used in all cases. This figure was kindly supplied by the Fuel Research Board for bituminous coal, and it appears to fit in well with the other experimental results.

The various Fourier Series used to calculate the average and surface temperatures of the cubes and rectangular blocks, and the differential equations involved in the $\bar{x}$ formula were worked out by Dr. A. G. Forsdyke, A.R.C.S., who was until recently a Beit Scholar in Mathematical Research at the Imperial College of Science and Technology.

*(To be continued.)*

## Letters to the Editor.

*(We do not hold ourselves responsible for the opinions of our correspondents.)*

### SIDE WIND AND THE RESISTANCE OF TRAINS.

SIR,—I have read Mr. C. F. Dendy Marshall's article on "Side Wind and the Resistance of Trains," in your issue of November 21st, 1930, and it certainly puts a point of view new to many people. But in his second example, where he says "We are doing what is equivalent to pushing the train through still air at 80 miles an hour at an angle of 60 deg. to its centre line, and that the amount of air actually encountered is 16 tons per sec.," should we be so impressed by this fact alone?

By this reasoning the same train standing still on the rails with an 80 mile an hour wind blowing at right angles to the centre line of the train might be said to be displacing about 18½ tons of air per second. If we suppose this train to be advancing sideways into still air at 80 miles an hour, we must also suppose the reaction on the flanges—that prevents the train being blown to leeward—to be advancing at 80 miles an hour with the train.

If this train is moved slowly so that the relative wind is 89 deg. to the centre line of the train, about the same amount of air is displaced per second. Is this equivalent to pushing the train through still air at 80 miles an hour at an angle of 89 deg. to the centre line of the train?

No great sustained force will be required to do this if there is no flange friction.

The friction of the flanges may not amount to much, but the reaction of the rails against the flanges at right angles to the train cannot be ignored in working out any force diagram.

In the slow-moving train this reaction resists most of the force of the wind, and a proportion at other speeds. This force acting at right angles to the train's centre line will not retard the train with no flange friction.

I see that the relative wind at 60 deg. to the train exposes the ends of all the other coaches and also other projections and recesses, all along the train, and will have a much more retarding effect than a head wind even with no flange friction. A full-rigged ship has more forward thrust with the wind on her quarter than a wind dead astern.

F. E. LINDSAY.

December 2nd.

### GLASS MAKING.

SIR,—My attention has been directed to a paragraph on page 510 of your issue of November 7th, in which there is an account of the advantages claimed in the melting of glass in tank furnaces when borax is a constituent of the mixture melted. The recognition for the advances made in this direction is ascribed to German experimenters.

This aspect of modern progress in glass making cannot be ascribed to German experimenters. The work originated on a large scale in America two or three years ago, and extensive tests have been carried out there mainly at the instigation of the American Potash and Chemical Corporation. Before they had proceeded to any great length I was invited in 1928 to carry out a thorough investigation with small-scale meltings to determine whether or not scientific tests could substantiate the advantages which already appeared to be gained in the large-scale operations, and to ascertain what additional advantages besides those already claimed might be expected.

The results of this systematic work were communicated to the Society of Glass Technology in June, 1929, and appear in the "Transactions" of the Society's *Journal*. Since that date further considerable large-scale tests have been carried out both in America and in this country. The suppliers of borax have, naturally, passed on the information to other glass-making countries, and I know from correspondence that some interest has been taken in the subject in Germany. But Germany certainly did not lead the way in this particular phase of glass making.

Sheffield, November 27th. W. E. S. TURNER.

## BOOKS OF REFERENCE.

*Kelly's Directory of the Engineering, Hardware, Metal, and Motor Trades.* 1930. Published by Kelly's Directories, Ltd., 186, Strand, London, W.C. 2. Price 45s. post free.—This, the nineteenth edition of this exceedingly useful book of reference, has recently been published. The volume is so well known that there is no need for us to explain its contents in detail. We may say, however, that it comprises :—(1) The names for each county arranged alphabetically under the towns and villages; (2) an alphabetical classification of trades for the London Postal District, with the names arranged under each trade heading in alphabetical order; and (3) a similar classification of trades for the rest of England, Scotland, and Wales. There are also :—(*a*) An alphabetical list of names of some 10,000 branded articles and specialities used in the engineering and allied trades, together with the names and addresses of the manufacturers; (*b*) an alphabetical list of the names, with addresses, of the manufacturers of iron and steel sections, together with the sizes made by each; and (*c*) a list of various brands which appear on iron and steel work, together with the makers' names and addresses. To give some idea of the diversity of matters dealt with, we may say that subjects as wide apart as Aerial Ropeway Contractors and Tin-plate Workers, and as Colliery Proprietors and Steeplejacks, are, among nearly 2000 other headings, included in its scope.

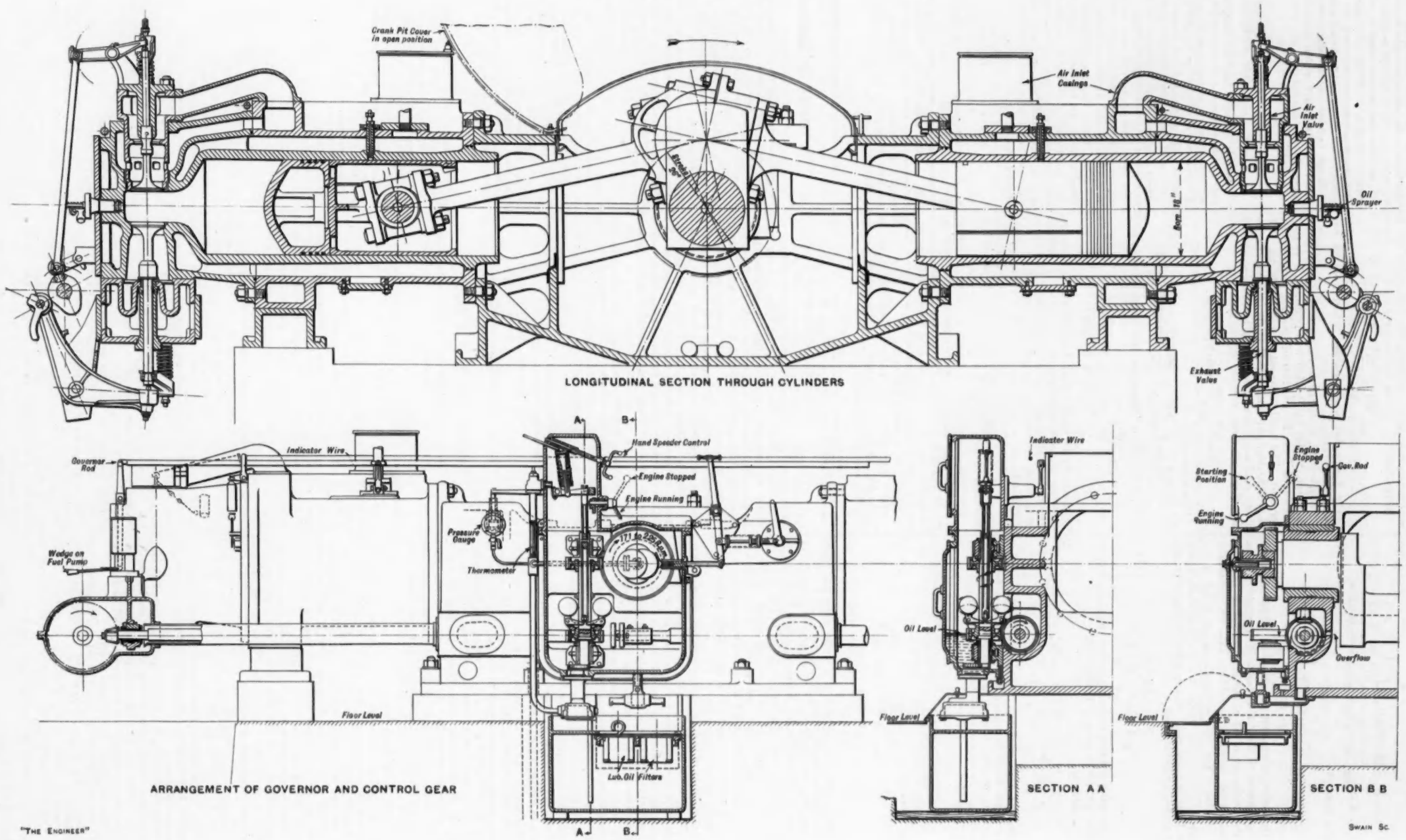
*The South American Handbook*, 1931. Edited by Howell Davies. London: Trade and Travel Publications, Ltd. Price 2s. 6d. net.—The eighth edition of this little volume is published at a very opportune time, owing to the interest all manufacturers in this country are now taking in South America in connection with the exhibition to be held at Buenos Aires. As in previous issues, the book contains a comprehensive chapter on each of the countries, opening with particulars of the important towns, followed by the physical features, Government, mineral and agricultural products, finance, industrial development and various means of travel. Every visitor to South America, either on business or pleasure, will find this reference book useful to him.

A BILL seeking powers to enable the Grand Union Canal Company to proceed with its £1,000,000 development scheme was deposited at the House of Commons on November 27th. The first part of the proposed scheme involves the rebuilding of locks, at a cost of £383,000 and the reconstruction of bridges, passing places, pumping stations and other works at a cost of a further £123,000. This part, it is expected, will be completed within three years if the Bill is approved, but six years will be necessary for the dredging, concrete walling and other works to be carried out at the cost of another £375,000. Further improvements are to be made by the company, to bring the whole of its undertaking to a state of the highest efficiency, and they will involve still additional expenditure of at least £150,000. The immediate aim is to enable barges in pairs—one motor-propelled and the other towed and between them carrying 137 tons—to pass anywhere along the canal from Regent's Canal Dock, Limehouse, to Birmingham. Each pair will be able to navigate the Thames and load cargo there or from the various docks, thus avoiding the present necessity for transhipping cargo from barges to narrow boats.

# 1000 B.H.P. EIGHT-CYLINDER, VIS-A-VIS HORIZONTAL OIL ENGINE FOR FEN PUMPING

THE PREMIER GAS ENGINE COMPANY, LTD., SANDIACRE, NEAR NOTTINGHAM, ENGINEERS

*(For description see opposite page.)*




LONGITUDINAL SECTION THROUGH CYLINDERS

ARRANGEMENT OF GOVERNOR AND CONTROL GEAR

SECTION A A

SECTION B B

"THE ENGINEER"

SWAIN Sc.

## 1000 B.H.P. OIL ENGINE ON THE TEST BED

## 1000 B.H.P. Vis-a-Vis Horizontal Oil Engine for Fen Pumping.

A FEW months ago we made a short reference in our columns to the new pumping station and outflow sluice which is being built at St. Germans, near King's Lynn, for the Middle Level Commissioners for the drainage of the Fens. The installation will comprise three horizontal Crossley-Premier eight-cylinder vis-a-vis oil engines, driving horizontal centrifugal pumps by Gwynnes, Ltd., and each of the pumps will have a suction pipe 102in. in diameter.

We recently paid a visit to the works of the Premier Gas Engine Company, Ltd., at Sandiacre, near Nottingham, and inspected on test the first engine for the above-mentioned contract. In what follows we describe the engine and its performance, and briefly refer to the possible applications of the same design for marine work, both for auxiliary lighting and refrigerating plants and for main propulsion using the electric drive.

### GENERAL DESIGN.

The view which we reproduce above shows the engine as it was arranged for brake test at the makers' works.

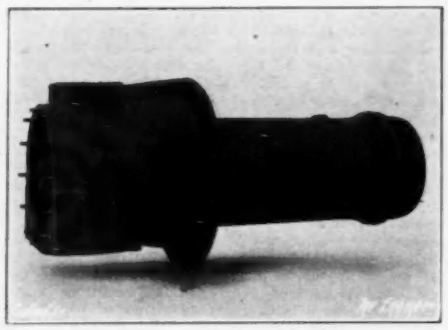


FIG. 1—BREECH END AND LINER

On the occasion of our visit it was running very quietly at full load on Anglo-American Diesel oil of 0·9 sp. gr., and was coupled to a Froude water brake. The design which has been adopted is especially noteworthy on account of its very compact and robust character, and while the main constructional details follow closely the builders' standard practice, some interesting new features have been introduced.

The arrangement of cylinders in opposed groups of four has made possible a very short and stiff crank shaft, which has been designed in accordance with Lloyd's Survey rules. The crank pins have a diameter of 12in. and the journals are 14in. in diameter with rectangular crank cheeks, recessed in such a way as to allow the pistons to be withdrawn from the liners with sufficient clearance for easy handling. The design of crank shaft is such that even after allowing for the special form of double-ended connecting-rods, the same cylinder pitch as used in the standard engines has been retained. The longitudinal section given in the upper view opposite shows the well-ribbed central bed-plate, and the stools below the cylinders. A special feature of the crank case is the provision of separate sumps for the used piston lubricating oil, which is thus kept apart from that oil which is mechanically supplied to the crank shaft journals and the big ends of the connecting-rods. Attention may be called to the one-piece casting for the liner and breech end of the cylinder, which is illustrated in Fig. 1. As the valve chambers and the adjoining combustion space are external to the main cylinder, which itself is practically surrounded by cooling water, the shape of the casting is such that the makers claim for it freedom from heat stresses and a homogeneity of structure which in practice has proved, we learn, exceedingly reliable and successful. From authentic records, which we were permitted to examine, we found that in no case had there been any fracture of a breech end casting, which could in any way be traced back to faulty design, workmanship, or material. Only in a very few isolated instances had failure taken place, and in them it was directly caused by a wrongly arranged cooling system after the engines had left the works or by a foreign body being inadvertently left in the cylinder after an overhaul had been completed. Although in most vertical marine engines a separate casting for the liner and cylinder head has generally been adopted, the reliability of the Premier design one-piece casting would seem to have been well substantiated in actual running practice over many years.

The new design of a combined big end bearing for the two connecting-rods deserves special mention, for the problem of providing ample bearing surface for the opposed rods on a single pin, along with adequate resistance to both inertia and pressure forces, resulting in a very cool-running pin, has been ingeniously solved by Mr. J. H. Hamilton, who for so many years has contributed so much to the designs of Premier gas and oil engines. On account of the patent position, we are unfortunately precluded for the present from illustrating this most interesting piece of work.

In Fig. 2 we reproduce a section through one of the pistons. It will be seen that the piston head is a separate casting, which carries four rings, and is attached to the skirt by a series of internal studs. The small end bearing of the connecting-rod is held in place by two long bolts. In vis-a-vis engines there is always a question of piston slap, resulting from the combination of under-running and over-running connecting-rods, and in the engine we are describing this problem has been overcome by slitting the piston skirt and inserting a tapered bush and draw bolt at the centre web of the piston pin boss. The draw bolt is fitted with a locking device and an indicator showing the degree of expansion of the piston. By turning the bolt a very small amount, the diameter of the piston can be increased a few thousandths of an inch over a large portion of its surface area. As will be seen from the section, on page 620, the right-hand pistons has the slit on the lower side for the under-running rod, while on the left-hand piston the slit is at the top for the over-running rod. This device has entirely obviated any question of piston slap, and we noted the very quiet running of the engine over a very wide range of speed.




FIG. 3—FUEL PUMP DETAILS

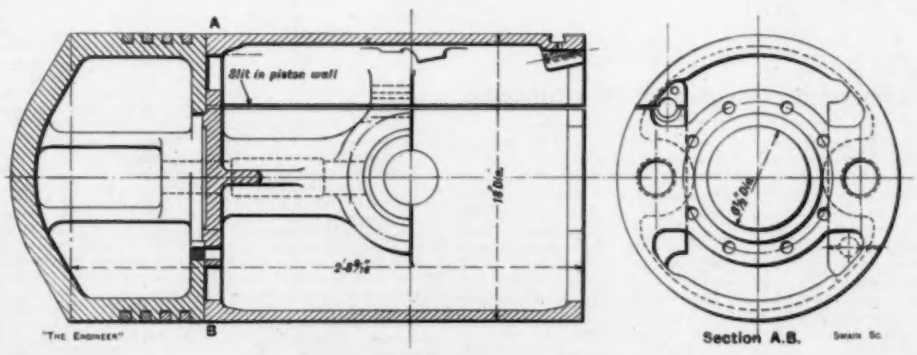



FIG. 2—SECTION OF MAIN PISTON

In our issue of March 27th, 1927, we gave a detailed description of a four-cylinder standard Premier oil engine at the Epsom waterworks, and described the valve gear. It is therefore only necessary to refer very briefly in this article to the very simple arrangement of the valves with their single operating cam and the provision of double springs, either of which can be removed and replaced, while the engine is running, by the use of a nut on the threaded spring spindle. Another useful device is a hand lever on the roller pin of the exhaust valve levers, which when turned puts the roller into contact with a raised portion of the cam, giving either half compression for starting or full compression release for barring round.

The engine is started on air at a receiver pressure of about 250 lb., there being starting valves on four of the eight cylinders. These are automatic non-return valves and are connected by air pipes to the distributing valve, which is cam operated. There is also a hand-operated air control valve. The engine started up very quickly and was immediately put on to load.

### FUEL PUMP AND GOVERNOR.

In Fig. 3 we illustrate the fuel pump, which delivers fuel to the spray valve at a pressure of about 1200 lb. per square inch when working under full-load conditions. The pumps, of which there is one for each cylinder, are mounted directly over the cam shafts, which are arranged below the main cylinders, and, as the drawing at the bottom of page 620 shows, are driven from the crankshaft by means of a side shaft and bevel gears. The gear drives are enclosed and the wheels run in an oil bath.

A feature of the fuel pump drive is the direct central thrust, which is obtained by means of a swinging lever which carries the cam roller and presses against a guided sliding piece. There are duplicate suction and delivery valves of the ball and spring controlled type, and the actual amount of fuel delivered to the cylinder is determined by a sliding wedge moved by the governor, which varies the lift of a mechanically operated by-pass valve. The pump is also furnished with a hand priming arrangement,

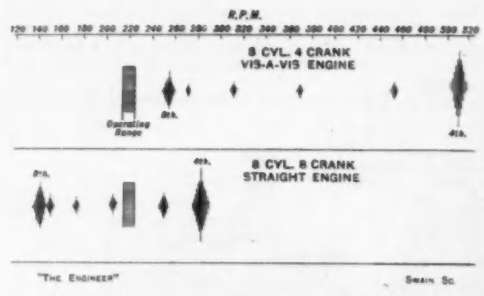



FIG. 4—CALCULATED CRITICAL SPEEDS

a hand-operated by-pass valve, and a hand adjusted valve for balancing the load on the various cylinders; this is clearly shown in Fig. 3. The governor is housed in the centre casing at the side of the engine, on which a hand speed control arrangement is fitted. The movement of the governor is transmitted to the wedge blocks by means of stiff rods along the side and the front and back of the engine. During our visit we saw the engine run up to a speed of 235 r.p.m., and within this range there was no trace of a critical speed. When the load was thrown off the governor took control immediately and there was practically no fluctuation in running speed. The trials which have already been made bear out the calculated critical speeds which are shown in comparison with those of an eight-crank engine of the normal type in Fig. 4. From the diagram given it will be noted that there is no eighth order critical speed until 250 r.p.m., while over 500 r.p.m. must be reached before a serious critical speed of the fourth order would be reached. These speed conditions compare very favourably with those of the eight-cylinder engine.

### TRIAL PERFORMANCE RESULTS.

The engine we have described, although designed to develop its normal power of 1000 B.H.P. at 214 r.p.m., can be run up to a maximum speed of 230 r.p.m. The compression pressure, as shown by indicator cards, is 450 lb. per square inch, with a final combustion pressure of 580 lb. per square inch. During most of the time we were present at the trials a constant output of 1008 B.H.P. at 215 r.p.m. was obtained, the mechanical efficiency under these conditions being 0·87 per cent. and the brake mean effective pressure 69·5 lb. per square inch, corresponding to an indicated mean effective pressure of 80 lb. per square inch. The exhaust gas temperatures were practically constant and a mean value was 395 deg. Cent.

The fuel consumption at full load was 0·38 lb. per square inch, the fuel being Anglo-American Diesel oil of 0·9 specific gravity, as previously mentioned. The trials also showed that the same fuel consumption was obtained at three-quarters load. The engine works under forced lubrication at a pressure of 8 lb. to 9 lb. per square inch, oil being supplied to the main bearings and the big ends. For the small ends of the connecting-rods mechanical lubricators are provided, which supply the oil to a wiper arrangement on the front of the piston which feeds the small end bearings. The same lubricators supply oil to the exhaust valve guide sleeve.

The above figures were recently confirmed by Mr. W. A. Tookey, M. Inst. C.E., M.I. Mech. E., of Westminster, who carried out exhaustive independent tests on a six-cylinder 750 B.H.P. Premier oil engine with the cylinders in one line. Mr. Tookey is also to test the vis-a-vis engine we have described. He found that the engine tested gave a full-load fuel consumption of 0·38 lb. of oil per B.H.P. hour corresponding to a thermal efficiency of 34·7 per cent.

After the preliminary tests of the vis-a-vis engine we have described were completed, some of the pistons and connecting-rods were removed and all working surfaces were found to be in excellent condition. The actual time needed to remove a rod and piston and place it on the floor was only half-an-hour. This quick work was made possible by the easy access to the crank shaft given by the light hinged covers and the special design of the big ends of the connecting-rods.

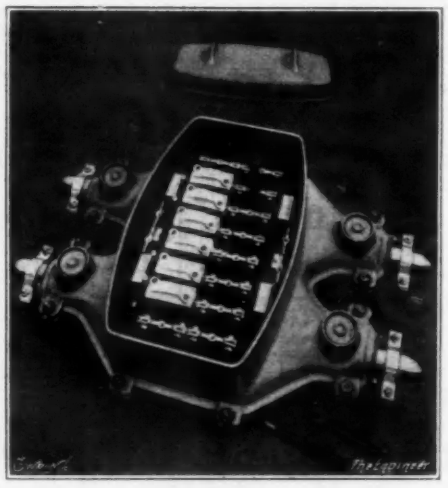
### POSSIBLE MARINE APPLICATIONS.

In THE ENGINEER of June 6th last we published an interesting article by Mr. Thomas Petty, who discussed at some length the possible uses of horizontal opposed-piston engines working in conjunction with gearing for ship propulsion. In view of the small overall dimensions of the vis-a-vis Premier engine, we have described, which only requires a head room of 12ft., the makers have recently put forward a scheme for two 1000 B.H.P. engines driving direct-coupled generators supplying current to a main propelling motor. The design includes two 40-kW auxiliary generators and the usual pump equipment. The proposal in question, which we recently examined, is for a ship of 45ft. beam, and the engine-room would only have a length of 43ft. We may recall the fact that all the refrigerating plants on the new motor ships of the Nelson Line are driven by horizontal Premier oil engines directly coupled to the ammonia compressors.

## Network Boxes.

A NEW type of link or fuse disconnecting box for four or five core cables with several interesting features has recently been put on the market by British Insulated Cables, Ltd. All the current-carrying parts are made from high conductivity copper strip, and the number of joints or contacts has been reduced to a minimum. The links are of the plug type, with bolted contacts. The bolts are fixed to the links and provision is made so that the bolts cannot turn when tightening, or the nuts be removed accidentally. The links are arranged for operation by means of special tools provided.

Ample room is allowed for opening out the cores of the cable, thus facilitating jointing. The accompanying illustration shows brass glands for making wiped joints on to the lead, but boxes can be supplied with lead strip bonding for both lead and armour with separate armour



ELECTRIC NETWORK BOX

clamps bolted on. The three-phase and neutral bus-bars and fittings are mounted on four insulated steel rods, supported at each end by cast iron brackets, which are bolted to, but insulated from, the cast iron box. The fifth core bus-bar and fittings are mounted on blocks of insulating material supported by wrought iron brackets. The phases are separated by means of a varnished teak frame, built so that compartments are provided for each set of links, and each phase is clearly distinguished by means of coloured glass reflectors fixed to the separators. Circuit labels are fixed in positions which leave no room for doubt as to which links belong to the circuit indicated. The boxes are of cast iron. The cover is of the diving bell type, designed to resist a 6ft. head of water, with a reasonable margin of safety. The matter of correct levelling of the box is one of considerable importance, as the sealing effect of the diving bell cover does not commence until its lower edge is completely immersed. To assist in determining that the box has been correctly levelled, the compound vent and filling holes over each cable entry are arranged so that the ledges supporting the small plates are in alignment with the compound level in the box. Any outflow of compound when filling the box, at one or other of these openings, would immediately show that the box was not level.

## MANCHESTER ASSOCIATION OF ENGINEERS.

A PAPER entitled "The Selection and Treatment of Gear Materials" was read before the Manchester Association of Engineers on Friday, 28th ult., by Mr. Francis W. Rowe, B.Sc. The paper was subdivided into the following sections:—Requirements of a gear; materials employed for gears; the treatment of steel gears; and examination of materials. Under the heading of requirements of a gear, Mr. Rowe included resistance to wear, resistance to stresses other than wear, and shock strength. In connection with the materials employed, the author said the use of case-hardened steels had rapidly extended during the last few years, owing largely to the needs of motor car engineers, and he referred to the nitrogen hardening process, which he described as one of the outstanding inventions of recent years. He said that the striking feature of the Nitralloy steels was that the case-hardening was conducted at a temperature of 500 deg. Cent. only, and no subsequent quenching was necessary. If the steel was free from strain when put in for nitriding—soaking at 500 deg. Cent. in an atmosphere of ammonia gas—the distortion which took place was only a fraction of what occurred in the ordinary carburising process. The case thus produced was intensely hard—diamond hardness of 1150, against 850 for ordinary case-hardened steel—and consequently more brittle. The process had many limitations, and because of them would never oust the ordinary case-hardening steels, but for many classes of work had decided advantages and filled a long-felt want. The disadvantageous attributes of the nitrogen hardening process were the less tough character of the case—owing to its greater hardness—and the limitation of the depth of the case obtainable—0·028in. maximum. Since also, to obtain full advantage of the non-distorting feature of the process, all machining had to be done before hardening, the steel must be in a machinable condition, *i.e.*, not more than 60 tons per square inch in the majority of cases before treating. This necessity naturally limited the core strength to this figure.

## RATIONALISATION IN THE IRON AND STEEL INDUSTRY.

THE decision taken at a recent meeting of the Council of the British Engineering Standards Association to appoint an Iron and Steel Industry Committee is one which will have a far-reaching effect in the iron and steel industry of the country.

The decision was arrived at as a result of a resolution passed by a fully representative conference held at the Institution of Civil Engineers on October 17th. The conference was presided over by Sir William Larke, K.B.E., director of the National Federation of Iron and Steel Manufacturers, and included representatives of upwards of 60 organisations and Government Departments, thus being fully representative of users and producers, and of the research and technical institutions, the conference being attended in their representative capacity by many of the leading engineers and technicians interested in the use and production of iron and steel.

We are informed that the desirability of reducing the number and requirements of specifications to the simplest form consistent with modern needs, and the necessity for co-operation between users and producers to secure this result, were recognised by all speakers. The reduction of unnecessary differences between specifications and requirements for similar services could only be secured by such co-operation as would be rendered possible by the appointment of an Iron and Steel Industry Committee through the operations of which it was confidently anticipated that productive efficiency would ultimately be increased. By the reduction of cost for a given service which must inevitably result, a stimulus would be given to the development of capital enterprise, which could not fail to have a substantial effect, as an important contributing factor in restoring prosperity not only to the industries concerned, but to those dependent upon them.

## NEW TURBO-ELECTRIC LINERS FOR THE DOLLAR LINE.

THE first of the two new turbo-electric liners ordered in American shipyards for the Dollar Line service from California, *viâ* Honolulu to Japan, China, and Manilla, is to be named "President Hoover," and she will be launched on December 9th, the naming ceremony being performed by Mrs. Herbert Hoover. The new liners, which will have a length of 653ft., with a beam of 81ft., and a depth of 52ft., are to have a displacement of 31,000 tons, with a measurement of 23,000 gross tons, and 15,800 tons deadweight carrying capacity, including 67,000 cubic feet of refrigerated space. The number of passengers to be carried by the various classes will total 1250, and there will be a crew of 300. Accommodation is to be provided for 320 first-class passengers and 140 passengers of a new special class, the remaining accommodation being allotted to the other ordinary classes. The new ship will be electrically propelled by a twin-screw arrangement of synchronous propelling motors, which will receive A.C. from two sets of turbo alternators, the steam being supplied by a modern boiler installation. The designed sea speed is to be 21 knots. The two new liners we have referred to are to form the first part of a building programme comprising four super-turbo-electric liners, which are included in the present building programme of the Dollar Steamship Line, of San Francisco. The "President Hoover" is being built at Newport News, Virginia.

MECHANICAL ENGINEERS FOR THE ARMY.—The War Office announces that there are vacancies for commissions in the Supplementary Reserve of Officers as Ordnance Mechanical Engineers in the Royal Army Ordnance Corps. In addition to qualifications as to character, medical fitness, nationality, &c., candidates must be under thirty years of age for appointment as subalterns, and under thirty-five for appointment as captains, and must also be fully qualified mechanical engineers. Preference will be given to Bachelors of Science (Engr.), Whitworth Scholars, Graduates and Associates of the Institutions of Civil, Mechanical or Electrical Engineers. Candidates will not be required to undergo training in peace time, but will be liable to be called out on service when the Army Reserve or any part of it is called out by proclamation, and to serve in any part of the world. In return for their obligation, officers will be granted an annual gratuity of £25, payable in arrear. When called out on service they will receive the rates of pay and allowances applicable to officers holding similar appointments in the Regular Army, and in addition will receive an outfit grant of such amount and under such conditions as it may be decided to issue to officers commissioned temporarily during the emergency. Full particulars and forms of application can be obtained from the Under-Secretary of State for War (A.G.9), the War Office London S.W.1.

## Railway and Road Matters.

THE greater portion of the London, Midland and Scottish express passenger train from Manchester to Yarmouth was derailed on Monday, December 1st, at Sheet Stores Junction, Trent, between Derby and Nottingham.

THE London, Midland and Scottish Railway Company is about to apply for powers to expend about £750,000 on an extension of its docks at Fleetwood. The larger part of the scheme will be the building of a new huge dock by enclosing the present open quayside and constructing massive concrete walls out into the river Wyre.

THE Minister of Transport has announced that during the month of November schemes for widening, reconstruction and other improvements of classified roads and bridges and for construction of new roads and bridges of classification value, involving a total estimated expenditure of about £2,250,000, have been formally approved for Road Fund grants, and work upon them should begin at an early date.

THE question of the pay and conditions of service of railwaymen is, we fear, likely to last for some time; it is fairly certain that it cannot be considered until the New Year. The exclusion from the scheme for revision of men in receipt of salaries of £350 a year and over has been commented upon in the Press, but it should be remembered that men in that position are outside the conciliation scheme. They were, however, subject to the deduction of the 2½ per cent.

IN an article on "Fog, Snow and Ice," in the November issue of the *Railway Newsletter*, it is stated that 2,000,000 detonators are used a year, and that huge quantities of salt are also provided for application to points to prevent them becoming blocked with ice. We do not know whether the above figure includes the detonators used all the year round to give warning when the line is obstructed by accident or engineering works. These must be as numerous as those required in fog-signalling.

WE wonder if, when Colonel Spender-Clay recently asked a question as to the number of keys and trenails used on British railways in a year, he had any idea what his inquiry involved. As there are at least 4224 keys per track mile of railway, and there are nearly 53,000 track miles of running line and sidings, it will be realised that Mr. Morrison had a difficulty in answering the question. The use of trenails, we would add, for securing chairs to sleepers is no longer British practice; screws only are now employed for that purpose, two on the outer side of the rail and one on the inner.

THE mention by our Paris correspondent, in his letter in our issue of November 28th, of the patrolling of railway tracks in France where there is likelihood of danger from slips and subsidences reminds us that that is very efficiently done in this country. Such an instance is to be found in the Warren, between Folkestone and Dover, where falls of chalk occasionally occur. Men are always on duty to watch the cliffs and telephonic communication to the adjacent signal-boxes is provided. It is the same at Penmaenbach, on the Holyhead line, and near Barmouth, on the former Cambrian Railway.

THE reference, in connection with the death of Mr. S. R. Wood, to his firm of McKenzie and Holland, railway signalling engineers, in this column on November 21st, prompts mention of the various lawsuits, in the late 'sixties and early 'seventies, as to patent rights in sundry details of the interlocking in the lever frame that actuates the points and signals from the signal-box. It is almost safe to say that in most of these cases Saxby and Farmer were the attacking party. Two actions deserve mention; in one that firm lost and in the other it won. In July, 1860, Saxby and Farmer took out their first patent for interlocking—there was an earlier one, in 1856, but it was rather for what is known as detection than for interlocking—and, later, they sued the rival firm of Stevens and Sons for infringement. When the case came for trial the defendants brought and had fixed in court a locking frame which had been inspected by Colonel Rich, on behalf of the Board of Trade, at Yeovil in the preceding March. Stevens had not patented the idea, but had the advantage of originality. The second case was unusually interesting and might be regarded as a test case. Saxby took out a patent on July 20th, 1867, and Easterbrook, another rival, did the same for a similar idea on the 23rd of the same month. The latter's patent was sealed first and he claimed priority of patent rights. A verdict for Saxby was given in 1873. Against McKenzie and Holland another action was brought by Saxby. The latter lost in the Court of Exchequer, but won on appeal; in the House of Lords, after four years' litigation, McKenzie and Holland again succeeded.

IT is twenty years to-day, December 5th, since the collision between two business trains at Willesden, in which five passengers lost their lives. The home signal that admitted the second train into the station was worked by No. 55 lever. The signalman had been using Nos. 16 and 19 points, the relative signal for which was connected to No. 53 lever. He claimed that instead of moving No. 53 he actuated No. 55 and admitted the second train by accident. As the man had asked a question of his assistant as to the previous train—of which there was no view from the signal-box—there was a doubt as to the error over the signal lever. Sir Arthur Yorke inquired into the accident and recommended track circuit. His report was, however, noteworthy because of the remarks made as to the alleged greater safety of two men in a signal-box. There were two experienced men employed in Willesden No. 5 box, "and yet the mistake occurred. It is by no means improbable that the division of responsibility between the two men was, in some way or other, the cause of the accident." An error by the boy in charge of the train register led to Sir Arthur saying that if accuracy in train registers could not be secured they were not only worse than useless, but might become a source of danger. He thought an automatic recording device of all the block signals sent and received was possible and that "the accuracy of the records and the check upon irregularities, which would be thereby effected, would, I believe, more than compensate a railway company for the cost of the machine." We would add that nothing has yet been done in the way of automatically recording block signals.

## Notes and Memoranda.

THERE are now eighteen towns in the province of Madras which are provided with an electricity supply.

A SWISS scientist, Mr. Julius Dettweiler, who has for some twelve months been engaged on research work in South Africa, announces that he has discovered a process of producing a synthetic bitumen from a combination of inferior grades of citrus fruits and powdered coal. It is suggested that this may be a very useful contribution to the problem of dealing with unmarketable oranges, said to be produced in the Union to the extent of 30,000 tons a year. We do not, says the *South African Engineer*, vouch for this figure, which seems, for the present at least, to be unduly high. It is not stated how and when the synthetic bitumen is to be applied. A provisional patent has been taken out covering its production, and Mr. Dettweiler is endeavouring to persuade a big citrus-growing concern to purchase the rights. The process is so far a secret.

IN a recent issue of *Stahl und Eisen*, Herr Eugen Piwowarsky published the results of his observations of changes which take place in the mechanical properties of hematite iron from the time of tapping from the blast-furnace to the pouring into moulds after passing through an acid mixer. The chemical composition and properties of sample bars cast in sand and in chill moulds directly from the blast-furnace during the charging of the mixer and during the emptying of the mixer were tabulated, showing the changes over a period of eight days, with an off day on the seventh day. Sand castings had better properties when taken directly from the blast-furnace, but chill castings were superior to sand castings poured from the mixer. In both cases an appreciable improvement in properties took place during the passage of the metal through the mixer.

THE wood distillation industry in Belgium is, says the *Chemical Trade Journal*, centred in the province of Luxembourg, the largest producer being the firm Les Produits Chimiques de Chimay, which has plants at Chimay and at Poix St. Hubert, and also two subsidiaries in France. It carbonises altogether some 50,000 tons of deciduous wood a year. Its yield from 100 kilos. of wood is 25 kilos. of wood charcoal and 55 litres of pyroligneous acid. This latter, on working up, gives 5 kilos. of wood tar, 4 kilos. of 100 per cent. acetic acid, and 1·5 kilos. of anhydrous methyl alcohol. The charcoal is graded into five different sizes for the market, the nuts being largely employed for transport vehicles working with suction gas. Exports from these factories are about 3500 tons of wood charcoal, 1500 tons of grey acetate of lime, 400 tons of sodium acetate, and 300 tons of methyl alcohol a year. Other products made by the concern are light and heavy tar oils, wood tar pitch, pyrolignite of iron, ordinary acetic acid, glacial acetic acid and formaldehyde.

A NEW type of steamship was, says the *Engineering News-Record*, introduced on the Great Lakes on November 10th, when the "J. R. Sensibar," the latest vessel of the Construction Materials Corporation's fleet, left Lorain, Ohio, on her maiden voyage. This boat, which represents an investment of 2,000,000 dollars, will go into the middle of Lake Michigan, fill itself with sand from the lake bottom at the rate of more than 50 tons a minute until its holds are full, de-water this 10,000-ton cargo if required, and transport it under its own power either to a storage dock to unload it automatically on to a pile of any height up to 80ft. or to a reclamation site along the lake shore to discharge it hydraulically through pipes at any point within 4 miles of ship side. The entire 10,000-ton cargo can be unloaded in three to five hours, according to its nature. The boat is designed for use, not only in transporting sand, but for carrying other cargo—coal, gravel, stone, &c.—so that it may be employed for a variety of tasks. The ship has an overall length of 556ft., beam of 56ft., and speed of 14 miles an hour.

SOME advice on the grinding of tungsten-carbide tools has recently been issued by the Carborundum Company, Ltd., of Manchester. In these remarks it is said that there has been much controversy regarding the use of water in grinding tungsten carbide because of the danger of "clinking." In commercial practice both wet and dry grinding are used successfully. Where the pressure of the tool against the wheel is kept low and care is taken to prevent overheating, dry grinding is satisfactory, especially when small amounts are to be removed. Wet grinding is to be preferred generally, provided the supply of water is ample. Little water is worse than none. There is less tendency for the wheel to load when used wet, and because of this fact and the absorption by the coolant of the heat generated in grinding the cutting action is much cooler, and harder grades can be used with resulting economy. Normally a wheel about one grade harder can be used in wet than in dry grinding. A tool that has become heated by dry grinding can be cooled by dipping the shank in water; the tip must not be immersed. Alternate grinding and tipping must also be avoided.

COMMENTING on the failure of the blow-down cock on a vertical dock crane boiler, the Engineer Surveyor-in-Chief, Board of Trade, says: The explosion was due to the wastage and consequent blowing out of a steel nipple used for securing the blow-down cock to the boiler shell. The cock was blown off, but warning of the impending explosion had occurred and the crane driver, after pluckily remaining to lower the load, managed to get clear in time. He was, however, severely injured in jumping to the ground. The use of such a nipple to join the fitting to the boiler shell is an objectionable arrangement, and as the screwed part projected into the bottom of the water space of the boiler, wastage was likely to occur. The nipple also appears to have been a poor fit originally. Under such conditions an explosion of this nature was a natural sequence. The wastage at the nipple, however, would be difficult to detect unless suspected, and as the arrangement was not likely to be noticed, suspicion would not be directed to it. The blow-down cock has since been refitted to the boiler by means of a brass nipple fitted with a shoulder and an internal nut, and the blow-down cocks on two other boilers have also been refitted in a similar manner. If the joints are made and remain tight, there should be no further trouble with these cocks.

## Miscellanea.

A DUTCH firm is arranging to manufacture all classes of dry batteries in Melbourne.

THE manganese ore which is being mined at Doornput, near Paling, South Africa, is said to contain 56 per cent. of metallic manganese.

THE first span of the new railway bridge over the Gouritz River, South Africa, was launched in October, and the structure is to be completed in May. The estimated cost is over £100,000.

THE loading plant of the Manganese Corporation at Congella, Durban, has started work. It is capable of handling 500 tons of ore an hour, and it is expected that when it is in full swing 2000 tons of ore will be loaded daily. Storage for 50,000 tons of ore is provided on the site.

THE London Chamber of Commerce has asked the Ministry of Transport, the Port of London Authority and the London County Council to co-operate in reconstructing at a more convenient point the swing bridge over the Millwall Dock entrance, the frequent opening of which causes considerable delays and financial loss to numerous local firms. Its inadequate weight-carrying capacity is also stated to have compelled local structural steel firms to decline orders for heavy work.

ACCORDING to a report from Moscow, the electro-technical industry of the U.S.S.R. produced, during the year 1929–30, goods to the value of 479 million roubles, compared with 264 million roubles the year before. It is estimated that in 1931, the value of the production of this industry should reach 1400 million roubles, or 500 million roubles more than was planned for 1932 under the Five-year Plan. At the present time Soviet works are constructing five turbo-generators of 77,500 kW each for the Dnieper power station.

A WIRELESS telephone service between New Zealand and Australia was opened on Tuesday, November 25th, and is to be available for 10 hours a day at a cost of £3 for a three-minutes' call. A through service between Britain and New Zealand is expected to be available in a few weeks. An experiment was tried recently, when Mr. Forbes, the Prime Minister of New Zealand, talked by wireless telephone from his hotel in London to Mr. Ransom, the Acting Prime Minister, in Wellington, New Zealand. It proved very successful.

THE Trans-Canada telephone system, which will make possible direct communication between Eastern Canada and Vancouver, will be completed by the British Columbia Telephone Company, which is constructing a line from Vancouver to the Crow's Nest Pass, a distance of 655 miles, at a cost of 1,290,000 dollars. All Canadian telephone companies are co-operating, and the entire circuit will be completed by the end of next year. The importance of the new line from a Dominion standpoint is that, at present, telephone calls from Vancouver to Eastern Canada have to be sent across the United States, *viâ* Seattle.

THE motor liner "Georges Philippar," of the Messageries Maritimes, which was launched recently from the yard of the Chantiers de la Loire, and was being fitted out at Saint-Nazaire, was considerably damaged by fire on Saturday last week. While a number of men were at work below, dense smoke rose, apparently from the cold storage compartments with their highly inflammable insulating materials. The plates on both sides of the ship became red hot, and it was several hours before the fire could be got under. The "Georges Philippar" was intended for the company's service to the Far East. Her length is 172 m., or about 564ft. 3in., and she has a displacement of 21,000 tons.

NEGOTIATIONS, which have been in progress in Canada for some months, for the formation of a Dominion air service, are now nearing completion. A new company, to be known as the Aviation Corporation of Canada, is being promoted by Mr. James A. Richardson, of Winnepeg, and President of the Western Canada Airways. The Corporation has under its control the Western Canada Airways, the Canadian Transcontinental Airways, the Canadian Airways, and other companies providing an air service from coast to coast. The Canadian National and the Canadian Pacific railways are financially interested in the project, which has the sanction of the Dominion Government.

THE limit of hardness of material that can be cut to economic advantage by the best modern coalcutters, is imposed less by the strength and power of the machine than by endurance of the cutter picks. Taking advantage of the development in the use of extremely hard non-ferrous alloys, as tips for tools in cutting of metals, Mavor and Coulson, Ltd., have carried out a series of experiments to determine the best compromise between extreme hardness with its consequent brittleness on one hand, and a degree of hardness combined with the requisite toughness on the other for cutter picks, with the result that a tipped pick is now available which will cut from three to four times the distance done by any tempered steel pick. These picks cannot be softened by heating, and cannot be made harder by heating and rapid cooling and are simply re-ground to shape when necessary.

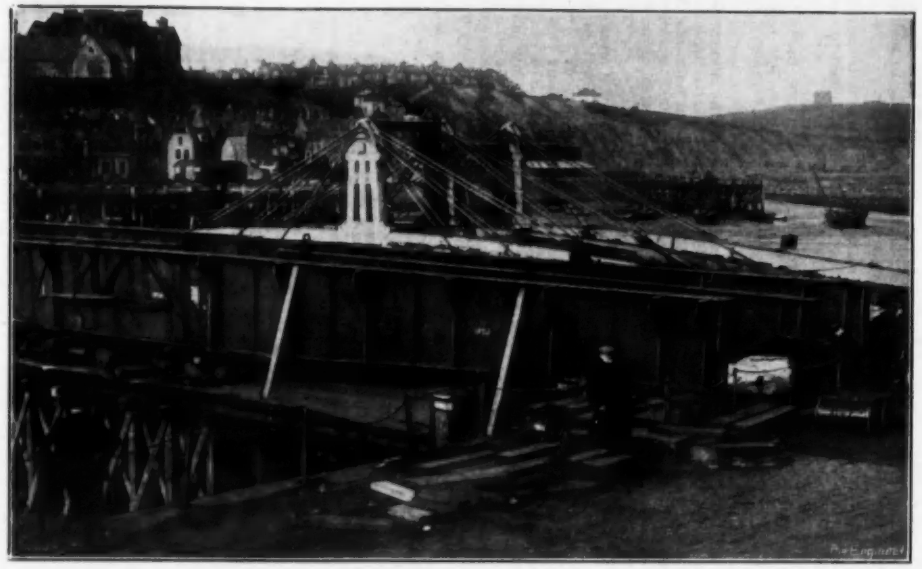
THE Port of London lags behind several of its British and foreign rivals in the facilities provided for "ship-to-shore" telephone communication, in the opinion of Mr. H. Willoughby Lovell, the Admiralty Marshal, who suggests that telephone cables should be laid to the principal buoys in the Thames, for the convenience of vessels lying in the river. Direct ship-to-shore connections have lately been established at Cardiff, Swansea, and Newport, and on the Tyne several berths have installations which make it possible, on the arrival of a ship, to place a portable telephone on board. A saving of time and money would, in Mr. Lovell's opinion, be effected if cables were laid to buoys in the Thames, for not only would telephones expedite the completion of the ship's business, by putting the master in instant communication with the agents, brokers and the port authorities ashore, but they would also prove invaluable in enabling assistance to be obtained in cases of accidents.

# FOLKESTONE HARBOUR—RENEWAL OF THE SWING RAILWAY BRIDGE

MR. GEORGE ELLSON, O.B.E., M. Inst. C.E., LONDON, ENGINEER

(*For description see page* 614.)

OLD WOOD BRIDGE AND STAGING FOR ASSEMBLING NEW STRUCTURE



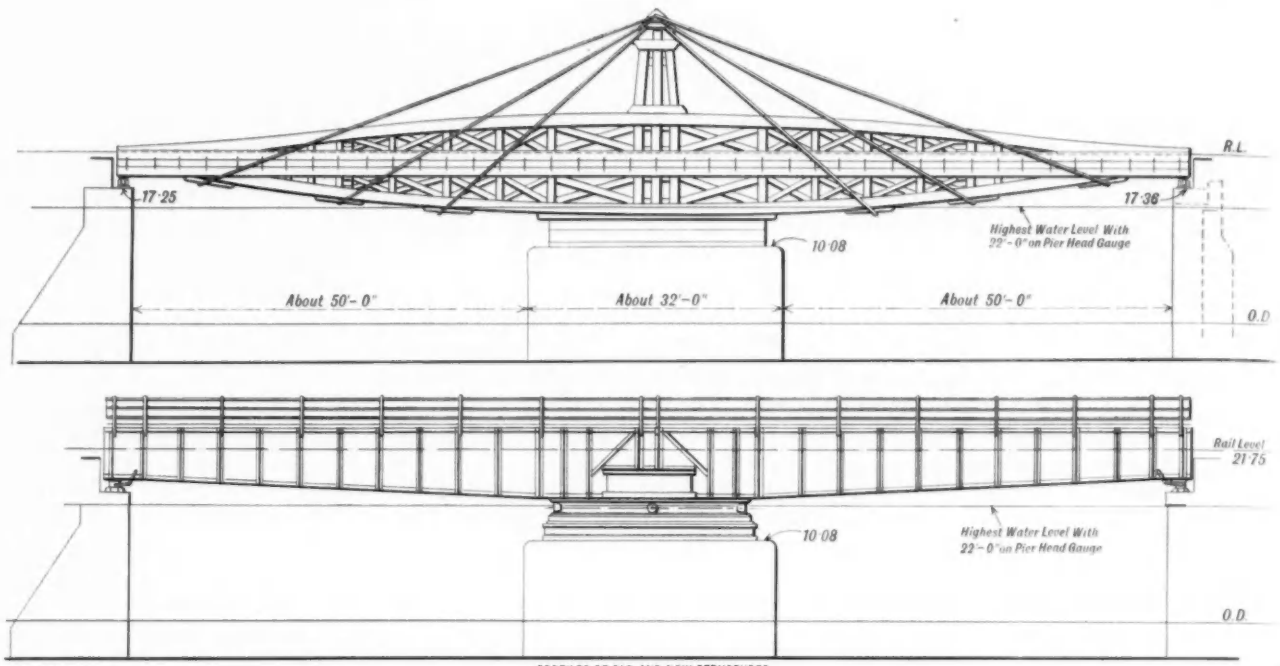
NEW BRIDGE ASSEMBLED BESIDE OLD WOOD BRIDGE

NEW STEEL BRIDGE BEING ASSEMBLED

DEMOLISHING OLD WOOD BRIDGE

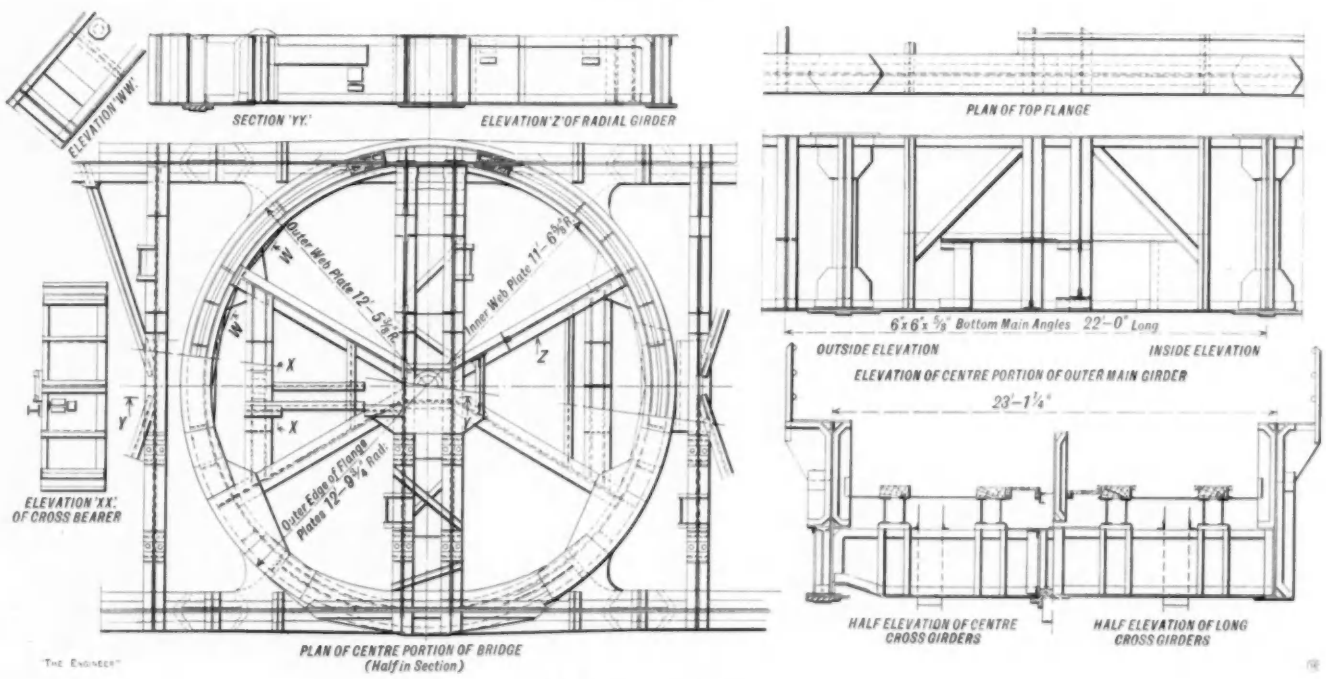
# . SOUTHERN RAILWAY—NEW STEEL SWING B

MR. GEORGE ELLSON, O.B.E., M. Inst.




PROFILES OF OLD AND NEW STRUCTURES

**DRAWING No. I.**


ELEVATION 'WW'
SECTION 'YY.'
ELEVATION 'Z' OF RADIAL GIRDER
PLAN OF TOP FLANGE
Outer Web Plate 12'-5 5/16"
Inner Web Plate 11'-6 5/16"
Outer Edge of Flange Plates 12'-9 1/4" Rad.
6"x6"x 5/8" Bottom Main Angles 22'-0" Long
OUTSIDE ELEVATION
INSIDE ELEVATION
ELEVATION OF CENTRE PORTION OF OUTER MAIN GIRDER
23'-1 1/4"
ELEVATION 'XX' OF CROSS BEARER
HALF ELEVATION OF CENTRE CROSS GIRDERS
HALF ELEVATION OF LONG CROSS GIRDERS
"THE ENGINEER"

PLAN OF CENTRE PORTION OF BRIDGE
(Half in Section)

**DRAWING No. III.**



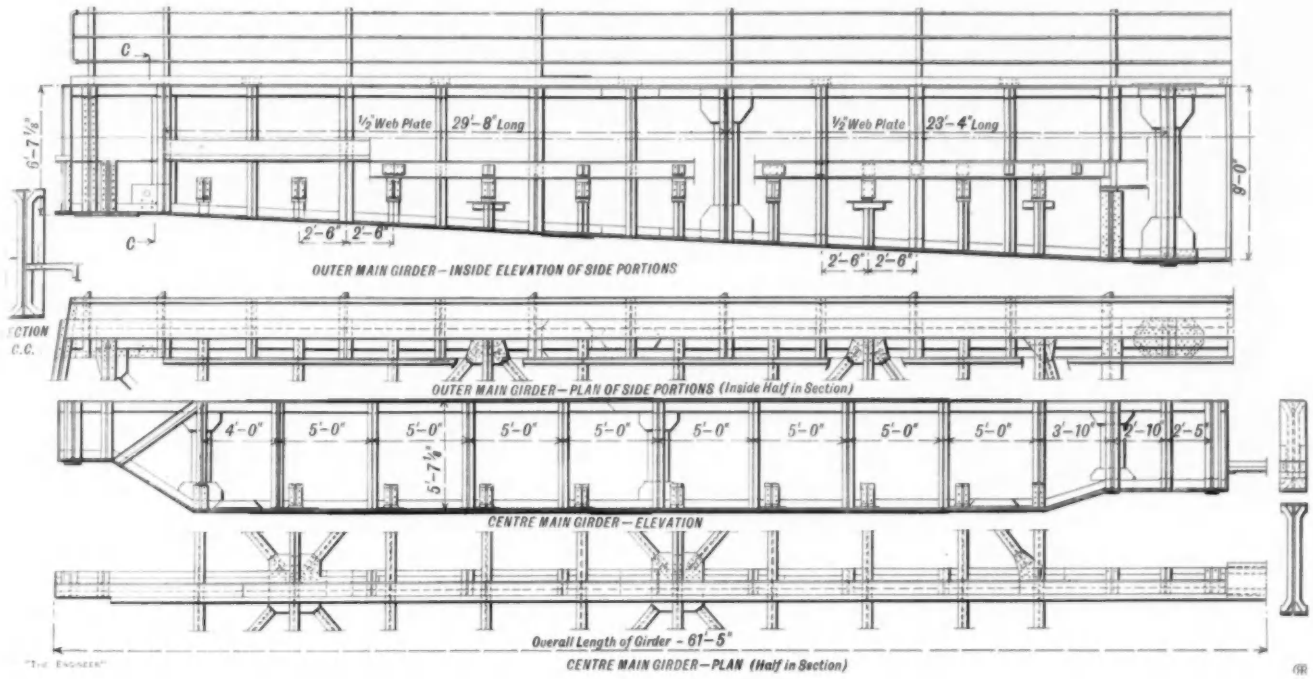

PLAN - PART OF UPPER TRACK PLATE - PART OF LOWER TRACK PLATE AND TRACK BASE CASTING

PLAN OF ROLLER RACE

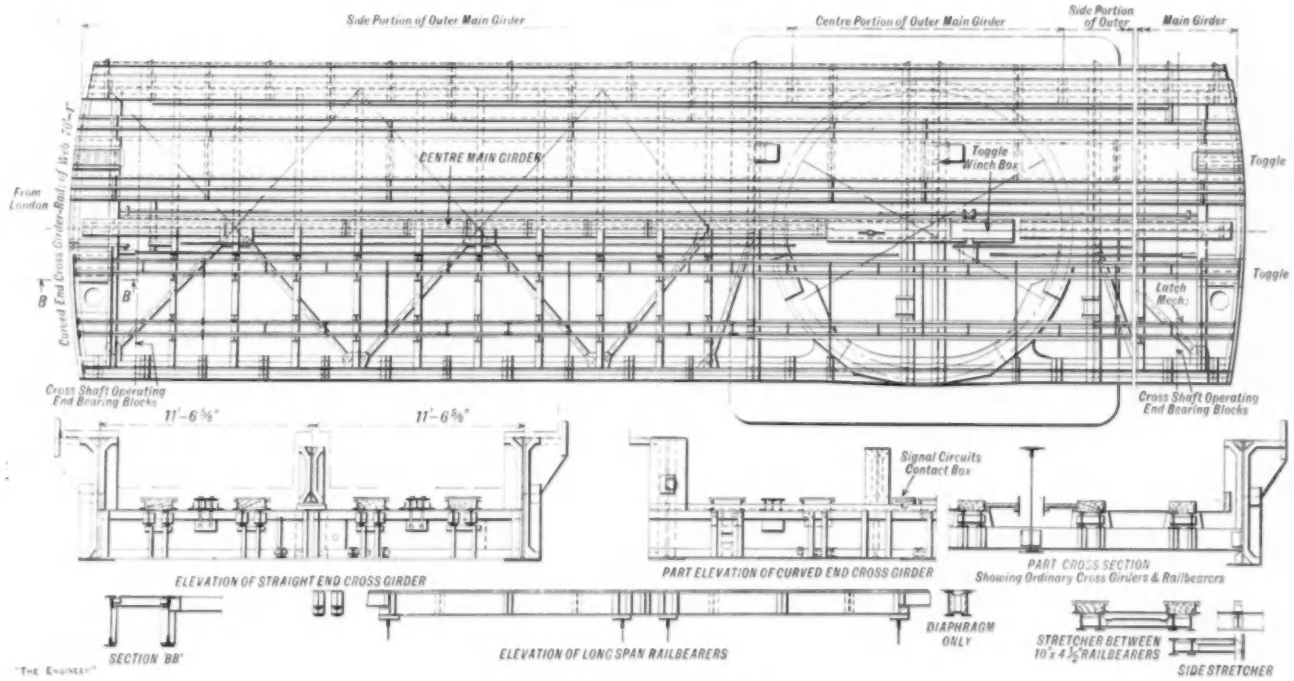
**DRAWING No. V.**

# ING BRIDGE AT FOLKESTONE HARBOUR

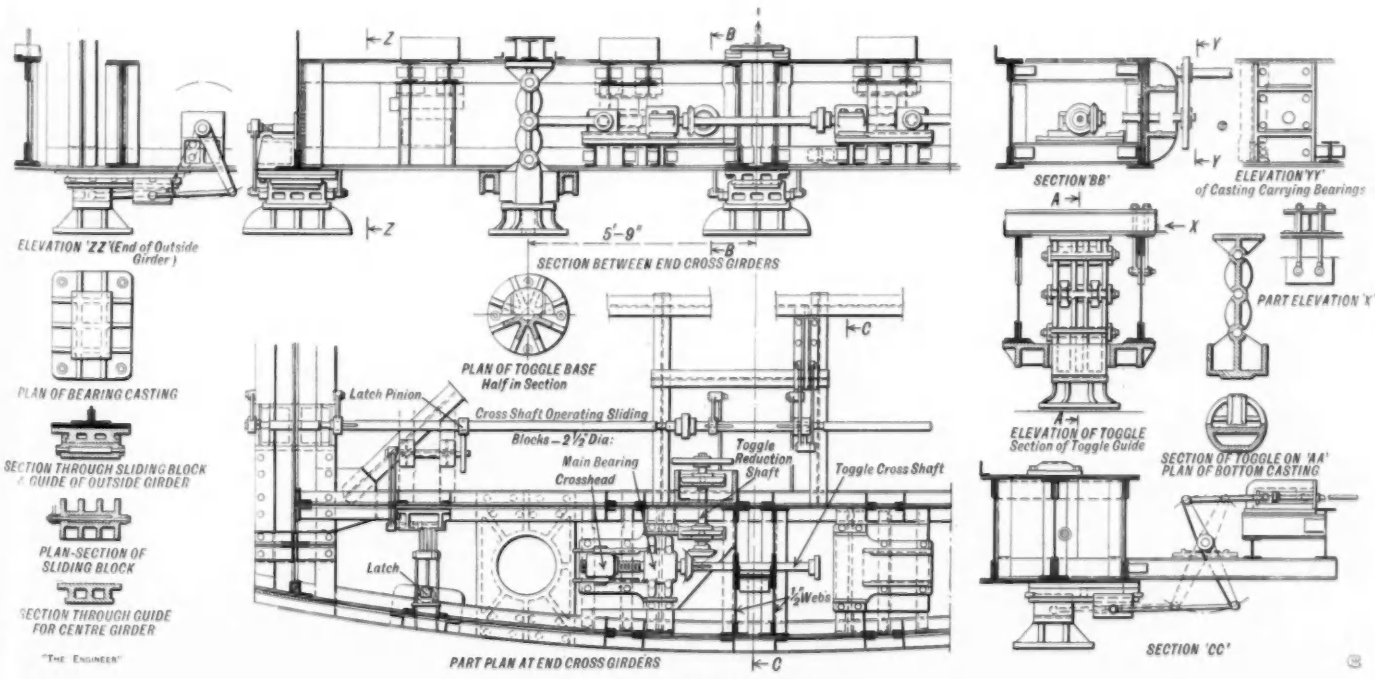
E., M. INST. C.E., LONDON, ENGINEER


½" Web Plate 29'-8" Long
½" Web Plate 23'-4" Long
6'-7⅛"
9'-0"
2'-6" 2'-6"
OUTER MAIN GIRDER – INSIDE ELEVATION OF SIDE PORTIONS
OUTER MAIN GIRDER – PLAN OF SIDE PORTIONS (Inside Half in Section)
4'-0" 5'-0" 5'-0" 5'-0" 5'-0" 5'-0" 5'-0" 5'-0" 5'-0" 3'-10" 2'-10" 2'-5"
5'-7⅛"
CENTRE MAIN GIRDER – ELEVATION
Overall Length of Girder - 61'-5"
CENTRE MAIN GIRDER – PLAN (Half in Section)

DRAWING NO. II.


Side Portion of Outer Main Girder
Centre Portion of Outer Main Girder
Side Portion of Outer Main Girder
CENTRE MAIN GIRDER
Toggle Winch Box
Toggle
Latch Mech.
Cross Shaft Operating End Bearing Blocks
11'-6⅝"
11'-6⅝"
ELEVATION OF STRAIGHT END CROSS GIRDER
Signal Circuits Contact Box
PART ELEVATION OF CURVED END CROSS GIRDER
PART CROSS SECTION Showing Ordinary Cross Girders & Railbearers
SECTION 'BB'
ELEVATION OF LONG SPAN RAILBEARERS
DIAPHRAGM ONLY
STRETCHER BETWEEN 10"x4½" RAILBEARERS
SIDE STRETCHER

DRAWING NO. IV.


ELEVATION 'ZZ' (End of Outside Girder)
5'-9"
SECTION BETWEEN END CROSS GIRDERS
SECTION 'BB'
ELEVATION 'YY' of Casting Carrying Bearings
PART ELEVATION 'X'
PLAN OF BEARING CASTING
SECTION THROUGH SLIDING BLOCK & GUIDE OF OUTSIDE GIRDER
PLAN-SECTION OF SLIDING BLOCK
SECTION THROUGH GUIDE FOR CENTRE GIRDER
PLAN OF TOGGLE BASE Half in Section
Latch Pinion
Cross Shaft Operating Sliding Blocks – 2½" Dia:
Main Bearing Crosshead
Toggle Reduction Shaft
Toggle Cross Shaft
Latch
½" Webs
PART PLAN AT END CROSS GIRDERS
ELEVATION OF TOGGLE Section of Toggle Guide
SECTION OF TOGGLE ON 'AA' PLAN OF BOTTOM CASTING
SECTION 'CC'

DRAWING NO. VI.

# The Engineer

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# THE ENGINEER.

VOL. CL. No. 3908


*DECEMBER* 5, 1930.

### British Engineering Industries.

A NOTEWORTHY pamphlet has just been issued by the Engineering and Allied Employers' National Federation. It is entitled "British Engineering Industry: Realities and Problems." We commend it wholeheartedly to the attention of all who are striving to follow the economics of industry, but particularly to those who are entirely satisfied with the principles which have inspired recent Governments, and the present Government in particular. It is intended for the general reader. It does not go deeply into the great problems that are vexing this country, but it shows broadly, and by salient statistics, the condition of British engineering at the present time, indicates the causes which have reduced it to a dangerous condition, exposes the fallacies behind these causes, and, by implication, leads the reader towards a consideration of the course that it is necessary to follow if the revival of this great industry is sought. It does not touch upon the popular panacea of the day. There is, we believe, no word in it about tariff reform, not a syllable about Empire trading, no reference to safeguarding. It deals simply and directly with the engineering industry as it is, and leads up to the conclusion, which ought by now to have been evident to everyone, that "we do not and cannot make the desired goods at such a price as can or will be paid for them."

To deal adequately with this pamphlet in a short article is impossible. It is economics in a tabloid, and almost all that we can do is to advise our readers to take a dose. But the tabloids are further compressed into a series of five and twenty conclusions, and these we reprint with much pleasure, and a lively hope that they will be read and pondered, upon another page. There are some who profess to think that technology is the only province of the engineer and that he need not bother himself about extra-parochial economics. The time is past when that limited outlook was both reasonable and safe. Engineering is no longer a matter of merely doing things. The purchaser does not bombard the doors of the manufacturers with orders. Great Britain is not a shop to which all must come; there are now many others, even within the Empire itself. Orders have to be sought for, and if they cannot be secured the reasons why they are lacking must be discovered. Many reasons, from indifferent organisation to ignorance of foreign tongues, have been advanced to show why the engineering industry of Great Britain is depressed. But when one comes down to rock bottom he finds himself face to face with the fact that the price of British products is too high for the competitive market. No amount of juggling can get over that elemental fact. No policy that the mind of man can conceive will make it possible to compete with foreign firms in neutral markets as long as our prices for similar goods are higher than those of our competitors. The study of economics will show us why they are higher, and will direct us to means by which they may be reduced. That is why acquaintance with that subject is so essential to engineers. Their very existence depends upon it; they may do much within the ambits of their own factories; they may do more by co-operation with other employers, but ultimately they find themselves face to face with the political economics of the party that happens to be in power, and unless they are strong enough to oppose effectively principles which are dangerous or disastrous to their industries they must inevitably witness the decay and even dissolution of the work to which they are devoting their energies. There are several such adverse forces to-day. Many of them have been discussed from time to time in these columns, but never have they been put so concisely and with such convincing pungency as in the pamphlet to which we have referred. Here we find them listed under the headings of Wages; Taxation; Local Rates; Trade Union Restrictions; and Difficulties or Costs Caused by Legislation. Taxation is given the first consideration. It is higher per head of population in this country "than in any with which our industries are in competition." Statistically it amounts, excluding local taxes, to no less than £15 13s. 10·6d. per head of the population, as against £7 17s. in Germany, £5 19s. in Belgium, and £6 3s. in the United States. Much of this taxation is required to meet social services which have increased out of all reason and, we submit, with an ill effect upon the workers of this country. Before the war we spent 63 millions upon those services, now we disburse nearly 400 millions. "The money," says the Report, "advanced for these purposes is so much money withdrawn from the total available for industry." It is this kind of expenditure, this fruitless and ill-considered subsidising of unemployment which has characterised British government in recent times, and it is against it that the leaders of industry must wage war. We do not wish to consider the influences which cause Governments to make and fulfil dangerous promises to the mass of the electors. We leave that to those political papers which happen to be in opposition. But the whole matter is of much deeper and greater importance. The welfare of the industries of the country depend upon wise decisions. It is therefore of the very first importance that the industrialists of the country should make their voice heard, and that there should be no cessation of their efforts to expose false policy and no relaxation of their endeavours to secure its repeal.

There may be some, even amongst manufacturing engineers, who will question the facts put forward in this pamphlet; some perhaps who will find a different interpretation for the statistics which are given in it. But, taken for all in all, it is difficult to see any means of escape from the ultimate issue. It may be true, as some will contend, that our prices are high because our methods are poor; but how can methods be improved when taxation is high and outputs are low? It may be true, as others will assert, that it is the duty of the State to see that every inhabitant can live in a state of decency, but that must cease to be possible if the coffers of industry are depleted; it may be true that the extension of the years of education will lead to the improvement of the British race, but how will that profit if the race cannot scrape together a bare existence? The great aspirations of the social reformers have our ardent sympathies, but those sympathies are tempered by a recognition of the inevitable fact that one cannot have improvements without paying for them, and that in the endeavour to provide them we are sacrificing and destroying the very means from which they must derive their support. By all means let us have the social improvements if they really make for good—free insurance, a higher standard of life, a more liberal education, luxurious prisons and attractive workhouses—let us have all these things and more, but

only when they can be provided without injury to industry and without hampering our power of competition with nations whose sociological ambitions are less exalted.

### Automatic Train Control.

THE automatic stopping of a train in the event of a driver trying to pass signals that are against him has been the subject of innumerable patents during the last eighty years. With the adoption of the block system and the improvements in the fixed, or outdoor, signals, the need for such an apparatus diminished. There, then, was recognised the necessity for some mechanical means for advising the driver of the condition of his signals in foggy weather. That need was evident to the inspecting officers of railways, who, during the last fifteen or twenty years of the nineteenth century, frequently recommended cab signals in their reports on accidents. Very little, indeed, was done by the railway companies in response to those suggestions, mainly because, whilst it was comparatively easy to repeat the "danger" indication, it was less easy to give "caution" and "clear." The Slough accident of June 16th, 1900, carried this question a stage forward, and there was a general agitation for the automatic control of trains. On that occasion the Board of Trade was found on the side of the railway companies, and Sir Arthur Yorke's report on that collision rendered good service in pointing out that the idea was less simple to realise than it seemed. Among the many good points he made was that "the efficiency of such an appliance would depend upon the care and intelligence bestowed upon the maintenance of its separate parts. Human agency is therefore not eliminated; the reliance, withdrawn from the driver, is merely transferred to man, or men, whose duty it is to look after the new apparatus." That opinion put an end, for the time being, to automatic train control. The importance of the question was, however, recognised by the railway companies, particularly by the North-Eastern and the Great Western, where Sir Vincent Raven on the former and some officers on the latter developed schemes for cab signalling alone, without the complications of automatic train control. These systems were put into successful service. Meanwhile, the Metropolitan District Railway, when converted to electric traction, put in automatic stops at its signals, which proved that that system was practicable. As a consequence, the report by Sir John Pringle on the collision of September 2nd, 1913, at Ais Gill advised that the question of train control be considered. Later, when the Great Western equipped the signals between Paddington and Reading, and the locomotives using that length, with its system of cab signalling, the automatic train control feature was added and its success proved.

In the United States the need for train control had long been manifest, and in 1906 the Inter-State Commerce Commission began to urge its adoption. The Commission had, however, no power to enforce its views and very little was done. Nevertheless, sufficient plant was put into operation to show that automatic train control was as practicable as it was desirable. The Commission, therefore, took advantage of the necessity of the Transportation Act, 1920, to include therein powers to order railways to install "train-stop or train-control devices or other safety devices." Meanwhile, collisions, less frequent and less disastrous, occurred from time to time in this country, and in the beginning of the second year of the Ministry of Transport, when it was at the height of its brief glory, a Departmental Committee was set up to formulate conclusions on the adoption of authomatic train control, in respect of all or any of its possible functions, having regard to the advantages to be attained and the cost involved. The Committee was appointed in October, 1920, under the chairmanship of Colonel Sir John Pringle, and reported on April 20th, 1922. It showed that of the 193 accidents inquired into by the inspecting officers of railways during the preceding ten years, 71, or 36·8 per cent., could have been prevented or beneficially affected by some form of train control, and that of the 71 cases, 56, or 78·87 per cent. of that number and 29·0 per cent. of the total of 193, were directly due to the failure of enginemen to observe and obey signal indications. The conclusion of the Committee was that a *prima facie* case for automatic train control had been made. The particular type of apparatus recommended was similar to that employed on the North-Eastern and the Great Western. It used a ramp which was electrified when the signal was at "clear" and dead when it was at "danger." A movable contact shoe on the engine picked up the electrical current, in the event of the signal being at "clear," but if the signal was at "danger," or there was a failure of the current, a "danger" instead of a "clear" signal was given on the locomotive. That there were difficulties in the way of the general adoption of this type was indicated by the final recommendation in the report that the companies should form a committee of experts "to determine and standardise track and locomotive apparatus, having regard to differences in structural and loading gauges, and the position of conductor rails on electrified railways." That such a committee of experts was necessary was shown by the observation, made by Sir John Pringle, in his annual report on the railway accidents of 1926, that "it appears, as a result of examination of the general question of automatic train control by the technical committee appointed by the railway companies, that there will be great difficulties experienced in selecting one standard form of automatic train control of the type recommended, owing to variation of under-clearances." Possibly in view of those difficulties, and probably because the ramp method had been abandoned in the United States, and inductive means employed instead, a second committee was appointed on November 1st, 1927, "to review the recommendations made by the Automatic Train Control Committee of 1922, and to consider and report what alterations, if any, should be made in that Committee's conclusions and recommendations, having regard to the developments that have taken place since that date."

The report of this further Committee, over which Sir John Pringle again presided, which is unanimous despite seventy general meetings, was issued on Wednesday last, December 3rd, as a Stationery Office publication. As all sufficiently interested in the subject can obtain a copy for sixpence, there is little need for us to say more than that all inductive schemes are ruled out and that the ramp system is recommended for general adoption; a new system of intermittent inductive control, which the Southern Railway has undertaken to try, remains to be adjudged. It may also be remarked that the clearance difficulties raised by the Committee of Experts do not appear as serious as represented; the slight alterations in fixed structures can be effected at no great cost, and the vehicles which do not provide the necessary under-clearance are few in number and mostly obsolescent in character. Electrically operated railways have an adequate trip system of control. The point of greatest interest at the present time is, however, whether automatic train control is justified. The present Committee, in summarising its conclusions ,says: "While the standard of security on British railways has been fully maintained during the past eight years, since the investigations and report of the previous Committee, we concur in their opinion that progressive action is desirable to reduce liability on passenger lines to the class of train accident which is under consideration." Figures are, however, given in the report which show that whilst engine and train mileage have increased since the ten years covered by the 1922 report, the average annual number of accidents of the kind under consideration has dropped from 7·10 to 6·25, despite an increase from 77·9 to 91·5 million engine miles. We suggest, therefore, that the conditions to-day remain as they were when Sir John Pringle said, in his annual report for 1926: "Justification for calling upon railway companies to incur the expenditure [of automatic train control] is therefore still lacking."

## Literature.

*Water Supply and Utilisation.* By DONALD M. BAKER, M. Am. Soc. C.E., and HAROLD CONKLING, M. Am. Soc. C.E. London: Chapman and Hall, Ltd. 1930. Price 30s.

THE scope of this work is defined by the sub-title, "An outline of hydrology from the view-point of the arid section of the United States, together with an outline of water law and its administration as it has developed in the arid States."

Apart from its value as a presentment of the dominant natural conditions affecting life and population in a large part of the United States, this special study will form a part of the technical and administrative literature of irrigation. As to the main problems, broadly considered, of irrigation engineering proper, the work is not important, but it furnishes very valuable data for use in the solution of those problems. On the administrative side, if the term can be applied to a subject in which the engineer and the administrator must work as one man, the book is usefully suggestive, for the problems of the irrigation administrator are those brought about by the development of claims, rights, precedents, benefits, and large increases in crops, such as bring into play the same ambitions, jealousies and conflicts, if these be not anticipated by wise and far-sighted statesmen and their fully informed officers. Thus, the information in Chapter XV. on Administration of Streams, is of great interest, since it gives information, covering 14 pages, as to statutory provision for the adjudication of existing rights in thirteen States, describes three methods, widely followed, of distributing irrigation water, and includes a discussion of distribution on streams when both storage and natural flow are involved. There is also a chapter on the evaluation of water rights, and one on water rights in underground water, besides the much longer one on water rights in surface streams, which includes a 12-page study of the doctrine of appropriation. The author explains in his preface that conditions in the western United States have developed certain institutions peculiar to that region and have necessitated departure in some respects from the common law of England. In a large area the common law doctrine of riparian rights to surface water has been superseded by the exclusive doctrine of appropriation. A useful economic study is that in the chapter on Conflict and Correllation in the Uses of Water.

Turning to the other aspect of the book, in regard to engineering and crops, which is a single subject where irrigation is successful, it is sufficient to remark, in respect of the author's handling of the principles and elements common to irrigation in all lands, that it is adequate for the purpose of the work and fully explanatory as concerns the particular conditions in the region with which it deals. The more interesting parts of the book, from the British point of view, may be briefly represented by a few references. In the region described, there is practically no plant growth between the first killing frost of the autumn and the last killing frost of the spring, and in the temperate zone, months with a mean temperature of less than 48 deg. Fah., constitute a period of rest for plants. This is in striking contrast with other regions in the temperate zone, though some in which there is irrigation may not furnish so extreme an instance as that of England, where the six months October–April have temperatures below 48 deg., in the range 0·7 to 9·4 and averaging 6.2. The importance of irrigation in the Western States may be judged from the fact that, while the population of States east of longitude 100 increased eightfold in the period 1790–1860, and nearly threefold between 1860 and 1930, the population of the seventeen western States increased about eighteenfold in the latter period.

Some of the data furnished in the book are of considerable interest. The results of carefully conducted tests designed to correlate pan evaporation rates with evaporation from free water surfaces are given in detail; also data showing the relation between rate of evaporation and conditions, such as temperature and specific gravity. There is also useful information relating to rates of evaporation from soils, to rates of transpiration through the leaves and stems of plants, and to relations between transpiration and soil moisture content. There are good chapters on Ground Water Hydrology and Ground Water in Alluvial Deposits.

Of about the same dimensions as Parker's "Control of Water," this book of nearly 500 pages, with 655 figures and 84 tables, excellently produced in all respects, contains much very readable matter and a considerable amount of data. While the demand, for individual possession, will necessarily be limited, it is a work which may very properly be distributed with some degree of liberality among the smaller offices of irrigation departments, and brought to the notice of those concerned with water law or with the farming of arid regions.

*Einführung in die Erdbildmessung* (*Terrestriche Photogrammetrie*). By HANS LOSCHNER. Leipzic and Vienna: Franz Deuticke. 1930. Price 10 marks.

IN the title of this introduction to Photographic Surveying on the Ground (Terrestrial Photometry), the word translated as "Introduction" must, as is usual perhaps in the case of the German word, be taken as used in the stronger sense, "leading into," not merely "up to." The distinction is of significance, for this book of 218 pages, including 121 figures, is a treatise on the subject. It is a systematic work, and Dr. Löschner has carefully recorded the names of many persons who have contributed to the development of photometry, even to the extent of pointing out that G. Hauck and A. Terrero furnished the same contribution, but independently, some forty-five years ago. In the first chapter are presented the elements of the subject, including an explanation of the measurement of angles, with vertical and with inclined plates, and a study showing the degrees of accuracy obtained by the former method under various instrumental conditions. The next chapter relates to single picture work, by the shore line method and the square mesh method. Mirror reflection, as an aid to the measurement of small objects, is also explained, and the use of photometry for the identification of criminals, as applied by Bertillon in Paris,

and later by Eichberg in Vienna, is discussed. The chapter concludes with a well-illustrated explanation of the photopolar method.

Part III., a very practical exposition, includes descriptions of operations coming under the heading Plane Table Photometry, which, the author observes, was first practised in 1851 by Aimé Laussedat (1819–1907). In the next chapter Stereophotometry is described, the method in which photographs are taken from two stations by parallel sightings, the theory being fully explained. Chapter V. is devoted to descriptions of the special instruments employed, phototheodolites, the compass instrument, the phototacheometer, and the stereo-phototheodolite, the optics of the last being explained. In the remaining chapters, the author describes in an able manner the practical procedure in the survey work, precise instructions being given as to the use of the less usual instruments, such as the "stereokomparator," the "autokartograph," and the "stereo-planigraph." The subject is presented much more fully than might be expected, for although the language is German, the style is comparable for clarity and directness with good English technical and scientific exposition. It may be believed that this methodical work will hold a good position in the literature of surveying. It is commended to the immediate attention of makers of surveying instruments.

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*The Principles of Structural Mechanics: Treated Without the Use of Higher Mathematics.* By PERCY J. WALDRAM, F.S.I. London: B. J. Batsford, Ltd. Second edition. 1930. Price 12s. 6d.

DELAYED by the cost of paper and printing after the war, this second edition of Mr. Waldram's important work is the more welcome in that it has been possible to produce it at the moderate price of five half-crowns. This is a point of some importance, for one of the difficulties in the way of those experienced engineers and editors who are asked to recommend books for specific purposes is that the total cost of the necessary volumes may be inconveniently great; for juniors and draughtsmen it is often prohibitive. This book is eminently one to be recommended as supplying the deficiencies of those in which the subject of structural mechanics is subsidiary to descriptions of structures and fully worked out calculations of typical problems of practical design; such as Mr. Waldram wisely excluded from his first edition and has found it impossible to incorporate in the present volume. Similarly, although he considers that ". . . . the subject of reinforced concrete calls somewhat loudly for a drastic clearance of the tangle of unnecessary and confusing algebra by which it has so long been overgrown . . ." he has found this matter too bulky to be included in the present volume. The book goes a very long way, however, in aiding the designer of reinforced concrete structures, for it supplies in almost all cases solutions of the problems as far as external forces are concerned, leaving the designer to calculate, from widely published sources, the proportions and dimensions necessary for resistance to the stresses in the members. Though this observation may seem to be a digression, it is closely to the point, for it serves to indicate the author's method. He first makes clear, in Part I., the nature of the forces and their relations to space and position, discussing loads and stresses, leverage and turning moments, and explaining logarithms, the slide rule and graphic statics. The last subject is further developed in the remaining parts of the book—II., Beams and Girders; III., Walls and Foundations; IV., Roofs; V., Arches and Domes; VI., Columns and Shoring.

The new matter is in three appendices. Appendix A explains how advantage may be taken of the coincidence in all girders of the points of minimum shear and maximum bending moment. Appendix B is a useful study of girders with fixed ends or continuous over intermediate supports, which may be commended to the attention of the engineers who wrote Part A in the British report on the "first question" to the Sixth International Road Congress, and, generally, to engineers responsible for the design of concrete road slabs. Appendix C is on the design of non-homogeneous members, a discussion of the behaviour of dissimilar materials acting in conjunction, which, as the author justly considers, includes some of the basic principles of design in reinforced concrete.

Well conceived, lucid, and very practical, this well-printed book of nearly 420 pages and furnished with 225 illustrations, is likely to be much in demand, and of those who use it many, no doubt, will hope for the early publication of the author's methods of clearing the tangle in which the subject of reinforced concrete is involved.

## SHORT NOTICES.

*Rural Electrification Safety Devices in Connection with Low-tension Distribution.* By Alfred Ekstroem and Vidar Ekstroem. London: Premier Linotyping and Printing Company, Ltd. Price 3s. 6d.—Although this is not the first book that has been written on rural electrification, it should not fail to meet with appreciation, as it deals with the subject on rather unusual lines. As the title implies, special attention is paid to safety devices in connection with low-tension distribution. From the practical man's point of view the volume is of particular interest, it emphasises the importance of safety and gives interesting statistics relating to accidents. By means of sketches, the authors show how accidents may occur and from these illustrated examples it should be an easy matter for those engaged on the electrification of farms, &c., to understand what they should avoid. Later in the book the authors deal with the construction of overhead distribution systems and faults in distribution systems. Here, again, sketches are given showing how faults may occur, and the effects of these faults on the system. Certain conclusions are given as to the precautions that should be taken in connection with faults. In the second part of the book special safety devices are dealt with. Earthing as a leakage protective device is considered in detail, and it is pointed out that, where earthing is found to be desirable, it should be carried out with every possible care. Artificial earthing and the Neutral Conductor as a leakage protective device form titles of other sections of the which concludes with examples of problems met with in connection with rural electrification, and short sections on "Faults in Consumers' Installations," "Insulation as a Protective Device Against Leakage Voltage," and a "Survey of Protective Devices." There is also an appendix on "Precautions that should be Taken with Electrical Installations."

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*The State of Volume of Oxygen at Low Temperatures.* By Dr.-Ing. Fritz Schmidt. V.D.I. Verlag, Berlin. Price 4 marks.—The purpose of this research work is to fill in the existing gaps in our present knowledge of the physical characteristics of oxygen in the temperature range between plus and minus 200 deg. Cent., and at pressures up to 150 atmospheres absolute, which cover the field generally used in practice. No complete "$p$ V" diagram could be developed from the existing experimental values, as only three isotherms up to 100 atmospheres and a few further values up to 60 atmospheres were known. The author established a general equation based on that of Van der Waals, which reproduced the experimental results within an accuracy of 0·5 per cent. With the aid of this equation a complete "$p$ V" diagram was drawn. The determination of the specific heat, "C $p$," presented special difficulties, as only a few figures at atmospheric pressure were available. From the factors of the equation, the missing values were calculated, and graphs were drawn which were in satisfactory agreement with the deduced values as determined by Hausen from throttle tests for air. The specific heat values were then used to draw the "T S" and "J S" diagrams, and the values for the heat of evaporation thus obtained showed a remarkable coincidence with the experimental values. The comparison between the values for the Thomson-Joule effect as obtained for the "I S" diagram, and those derived from experiments, showed good agreement. The diagrams which have been drawn by the author should be of value not only to engineers, but should also add to our general knowledge of the behaviour of gases at low temperatures.

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*Engineering Insurance.* By H. R. Sketch. London: The Post Magazine and Insurance Monitor, Ltd. 1930. Price 5s. 6d.—This volume has been compiled from the notes for a series of lectures delivered to the students of the Chartered Institute of London. It is intended to cover all the principal aspects of the insurance of engineering materials and is addressed principally to persons whose technical knowledge is relatively limited. It opens with an interesting introduction, in which the origin and history of engineering insurance since its foundation by the Manchester Steam Users Association in 1854, is given. Then follow eight chapters which run in pairs. Chapter II. gives a general outline of steam boiler design, and is immediately followed by one on "Boiler Policy." The next pair is devoted to Engines and Steam Engine Policy; the next to Electrical Plant and Electrical Plant Policy; and the last to Lifts, Hoists and Cranes and the policy appropriate to that subject. In a final chapter, Office Routine is discussed. The book is one that should be useful to all who are engaged in the business of engineering insurance, but, needless to say, it must be regarded as only introductory, and cannot take the place of experience.

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*Builders' Materials.* By R. F. Grundy, B.Sc., &c. London: Longmans, Green and Co., Ltd. Price 5s. net.—The author states in the preface that the book was written with the object of supplying a concise and quick reference volume for those engaged in the building trade. The first section deals with timber, its formation, uses, types and properties, including preservation and polishing. Stone is the next subject and particulars are given of its bedding, laying, jointing and preservation, followed by classified lists of stones used in building, their composition and uses. The manufacture of bricks, earthenware, stoneware, terra-cotta, iron and steel, and some particulars of non-ferrous metals are dealt with. The remainder of the book comprises chapters on lime, gypsum, plasters, cements, concrete, glass, paints, &c. The volume includes also chapters on iron and steel, lead pipe and glass, and concludes with a short outline of paint and varnish technology and some remarks on miscellaneous materials.

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*Testing Radio Sets.* By J. H. Reyner. London: Chapman and Hall. 1930. Price 10s. 6d.—It is supposed that most of our readers who use "wireless," being technical men, take a scientific interest in the apparatus; many no doubt make up their own sets and some even conduct researches of a less or greater order upon them. To all this book will be welcome. Nothing can be more provoking than a hidden fault in a receiver; one may spend hours searching for it, and then find it either in some absurdly obvious place or in a faulty component. Mr. Reyner gives very useful practical instructions for the discovery of faults and describes quite lucidly the simple apparatus that meets all ordinary requirements. All who have little libraries of wireless books will be glad to add this volume to them.

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*A Catalogue of British Scientific and Technical Books (British Science Guild).* Third edition. Compiled by Daphne Shaw. London: A. & F. Denny, Ltd. Price 20s. net.—Every librarian will welcome the third edition of this catalogue, which is the most useful work of its kind published in this country. It contains particulars of some 13,915 technical books issued up to September, 1929, by 627 publishers, covering all branches of science and technology. A careful perusal of the sections connected with the engineering trades does not disclose any serious omission. The book can well be recommended to all whose work brings them into contact with engineering literature.

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## BOOKS RECEIVED.

*Cours d'Optique.* By G. Bruhat. Paris: Masson et Cie, 120, Boulevard Saint-Germain, VIe. Price 100f. net.

*Liverpool and Manchester Shipping, Who's Who?* Liverpool: *The Journal of Commerce*, 17, James-street. Price 2s. net.

*London and Southampton Shipping, Who's Who?* Liverpool: *The Journal of Commerce*, 17, James-street. Price 2s. net.

*Agricultural Research in 1929: The Royal Agricultural Society of England.* London: John Murray, Albemarle-street, W. Price 1s. 3d. net.

*Ancient System of Irrigation in Bengal.* By Sir Wm. Willcocks, K.C.M.G. Calcutta: Publication Department, University of Calcutta, Senate House.

*Concrete Products and Cast Stone.* Fourth edition. By H. L. Childe. London: Concrete Publications, Ltd., 20, Dartmouth-street, S.W. 1. Price 6s. net.

*Further Experiments on the Discharge of Models of Sluices.* By H. E. Hurst. Cairo: Publications Office, Government Press, Bulâg. Price P.T. 10.

*Examples in Engineering Design.* Second edition. By G. W. Bird. London: Sir Isaac Pitman and Sons, Ltd., Parker-street, Kingsway, W.C. 2. Price 6s. net.

*London University Guide and University Correspondence College Calendar,* 1931–32. Cambridge: University Correspondence College, Burlington House. Price 2s. 6d. net.

*An Introduction to Structural Theory and Design.* By H. Sutherland and H. L. Bowman. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 17s. 6d. net.

*Compressed Air Plant: The Production, Transmission and Use of Compressed Air.* Fifth edition. By R. Peele. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 37s. 6d. net.

*Annali dei Lavori Pubblici (già Giornale del Genio Civile), Ministero dei Lavori Pubblici, Consiglio Superiore.* 1930. Fasc. 9, Settembre. Rome: Provveditorato Generale dello Stato, Libreria. 1930.

*American Railway Signalling Principles and Practices.* Chapter 8, *Electro-pneumatic Interlocking*; Chapter 9, *Rectifiers.* New York: American Railway Association, Signal Section, 30, Vesey-street, U.S.A. Price 35 cents per chapter.

*An Early Experiment in Industrial Organisation: Being a History of the Firm of Boulton and Watt,* 1775–1805. By Erich Roll, B. Com., Ph.D. London: Longmans, Green and Co., Ltd., 39, Paternoster-row, E.C. 4. Price 15s. net.

## SIXTY YEARS AGO.

IN our issue of December 9th, 1870, we could find little that was complimentary to say concerning those charitable people in this country who were devoting their time and money to the relief of the sick and wounded in the Prussian and French armies. An occasion for passing comment on this subject was provided in the introduction to an article—the fifth of a series—on army surgical and commissariat appliances. Something approaching £300,000 had been collected in this country for the equipment on the Continent of ambulances and field surgeries. The scheme, we said, was an illogical absurdity and those promoting it were irresponsible adventurers. Our ire seems to have been aroused by the fact that recently, from the money collected, £20,000 had been handed over to the Prussians investing Paris, to enable them, as we put it, the better to besiege it, and a like sum to the Governor of Paris to enable the city the better to hold out against the Prussians. So far as the first gift was concerned, we did not regret to notice that the Emperor's thanks were couched in terms which amounted to a direct insult. As for the second gift, it was equivalent, we said, to offering Noah while imprisoned in the ark shekels of gold wherewith to buy fishing nets or food for his floating menagerie. If all the funds had not been expended it would be better, we said, to devote what remained to providing food for Paris as soon as its gates were once more opened and seed corn for the downtrodden and unploughed fields of Northern and Eastern France. Meanwhile the siege was proceeding towards its inevitable end. Our Paris correspondent, writing under date November 22nd, reported that the meat ration had been cut down to two ounces a day and that horseflesh was being used as food. Nevertheless, the Parisians still retained their optimism. They were told by responsible people that provisions and other supplies would come into Paris very soon and that a few days would show them the enemy's back. In two months' time the inhabitants had performed wonders in the defence of their city. It would seem, however, that reports concerning what they had achieved lost nothing in the telling. It was not our Paris correspondent who, in the issue quoted, was responsible for the statement that among the implements of defence with which the capital was now provided were not only armoured locomotives and various forms of mitrailleur, but a device called a mower, which, although it cost only 35f., could throw 300,000 balls five or six hundred yards without smoke, noise or fire. It was also reported that the French had at their disposal bombs emitting suffocating vapours and a rocket so terrible that they hesitated to commit the wholesale slaughter of the Germans which its use would entail.

## Summation Metering Equipment.

DURING a recent visit to the works of Ferranti, Ltd., of Hollinwood, Manchester, the firm's summation metering equipment was brought to our notice. The diagram, Fig. 1, shows the equipment required for the summation metering of a complete station having two-way transformer circuits, three generators, and a station auxiliary machine, and arranged to give in addition to the readings of the individual meters the kWh and reactive kVAh import from the transformers, the kWh and reactive kVAh output of the generators, and the kWh and reactive kVAh supplied to the station for the purpose of the undertaking.

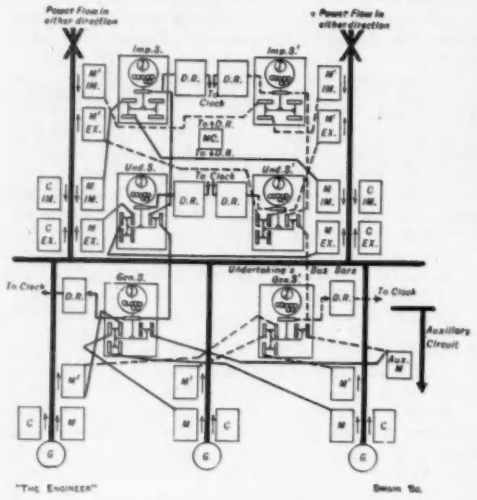


FIG. 1—METERING DIAGRAM

The following key to the diagram will enable the arrangement of the equipment to be understood :—

| | |
|---|---|
| M. | Main integrating meter (kWh). |
| M¹. | Main integrating meter (reactive kVAh). |
| C. | Check integrating meter (kWh). |
| G. | Generator. |
| D.R. | Demand recorder printometer type. |
| M.C. | Master clock. |
| AUX.M. | Auxiliary circuit meter. |
| IMP.S. | Import summator kWh and maximum demand indicator. |
| IMP.S¹. | Import summator reactive kVAh and maximum demand indicator. |
| UND.S. | Undertaking's summator kWh and maximum demand indicator. |
| UND.S¹. | Undertaking's summator reactive kVAh and maximum demand indicator. |
| GEN.S. | Generator summator kWh and maximum demand indicator. |
| GEN.S¹. | Generator summator reactive kVAh and maximum demand indicator. |
| IM. | Import meter. |
| EX. | Export meter. |

Integrating meters are inserted at the points at which the kWh or reactive kVAh are required to be measured,

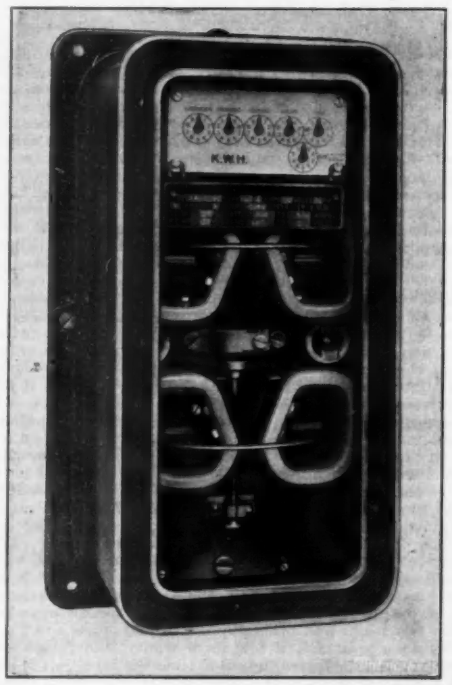


FIG. 2—INTEGRATING METER

these special meters, which are illustrated in Fig. 2, being of the balanced thrust type, in which each of the usual driving and braking elements is replaced by two smaller elements, so arranged that the side thrust on the pivots usual in induction motor meters is eliminated; whilst 70 per cent. of the weight of the movement is carried by a permanent magnetic suspension. These features, coupled with the fact that the full load revolutions do not exceed 28 per minute, result in a greatly lengthened accurate life. If required, the counting train can be prevented from backward rotation by a pawl, and a free wheel can be fitted between the disc spindle and the train, so that the former is free to rotate in either direction, thus preventing any shock from sudden stoppage of the disc. The reactive kVAh meters are identical with the energy meters, quadrature transformers, as shown in Fig. 3, being employed to give the necessary 90 deg. phase shift in the voltage supply, so as to obviate the necessity for making

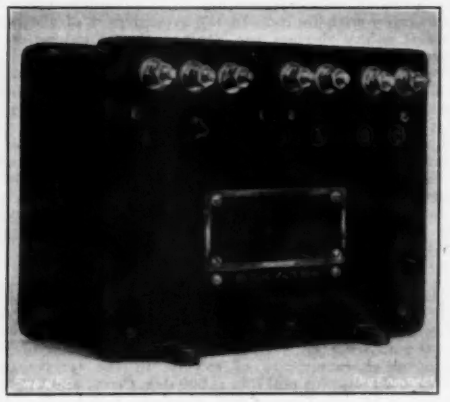

FIG. 3—QUADRATURE TRANSFORMER

any connection to the neutral point of the voltage transformer.

The summation mechanism, illustrated in Fig. 4, consists of a two-way contactor driven by an auxiliary spindle geared to the main meter spindle, and is fitted with heavy silver contacts moved positively in each direction by jewelled rollers bearing on a cam. By means of these contacts local circuits are closed, the contacts being connected by wires to one of the elements of a summator, as illustrated in Fig. 6, and which may be situated at any convenient point. The summator, which may be made

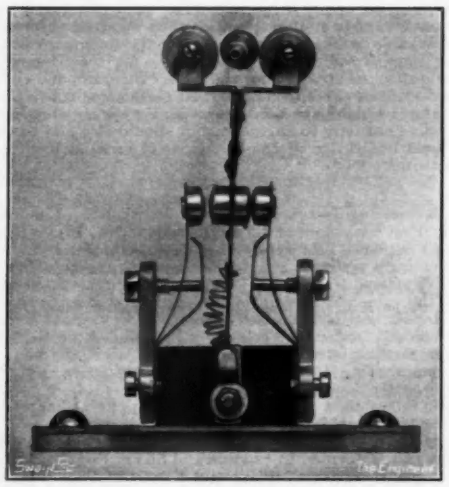

FIG. 4—SUMMATION MECHANISM

to total the readings of any number of integrating meters, consists of separate pairs of coils for each element, each pair being energised from the summating mechanism of one meter, the armature of each pair of coils actuating mechanisms which drive a set of revolving spindles through differential gearing, and these spindles are finally geared to a master spindle and wheel which operate a train of wheels giving the total indication.

The summator operating mechanisms are made and connected so that no return spring is necessary, the armature being pivoted and unconstrained, so that it may float between the poles of the electro-magnets. As a

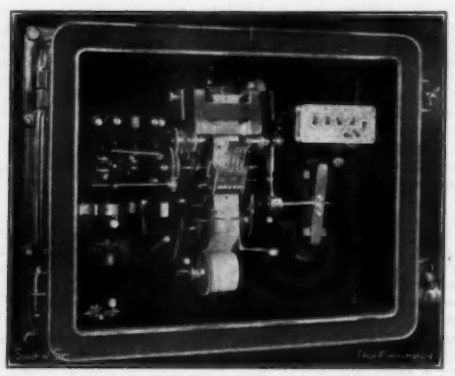

FIG. 5—PRINTOMETER

very small current is required to energise the electro-magnet windings, impulses may be transmitted long distances by wires of small sectional area. To prolong the life of the contacts and to avoid inductive interference with other circuits, buffer resistances are connected across the coils, so as to reduce contact sparking. At each side, between it and the pole faces, the armature carries phosphor-bronze spring strips, the objects of which are:— (1) to prevent contact between iron and iron, which tends to cause sticking due to residual magnetism; (2) to act as buffers to minimise wear; and (3) to allow the armature partly to return to its midway position after its initial pull, so that the air gap in the reverse direction is reduced, and less power is required to move the armature on the next impulse. Moreover, in order to minimise shock and jerky action, the armature drives the notching mechanism by means of a flexible phosphor-bronze strip, and the notching mechanism has a restraining pawl and prevents one impulse from causing a rotation of more than one tooth of the ratchet wheel. The transmission to the differential gear from the rotational movement produced by the armature through the ratchet and pawl is by means of a coupling, consisting of springy wires arranged around the periphery of a circle, so that any sudden impulse tends to be damped out and wear on the mechanism is reduced to a minimum.

For the operation of demand recorders or other similar apparatus a contactor mechanism similar to that used on the summating meters is geared to the final spindle of the summator and an aluminium disc on the spindle rotating between the poles of the permanent magnet, combined with a system of spring storage of impulses, ensures even rotation of the mechanism and results in uniform impulses to the demand recorder or other apparatus operated through the final spindle.

As in the case of the summator shown in Fig. 6, the final spindle can be used to operate a maximum demand indicator by allowing it to drive a pointer or set of pointers on a dial which is required to indicate the maximum kW received by the summator in any given period—usually half-an-hour. For accurate readings the dial divisions should be numerous in order that a very small change may be detected, and this end is attained in the following manner. The rod from the summator drives the pointer through a clutch by means of gear wheels which are adjusted so as to read directly in some multiples of 10 kWh, so as to obviate the necessity for a multiplying constant. This pointer traverses a scale of 300 deg., the top point being some figure in excess of the total reading to be indicated. Geared to the same pointer is another pointer which can rotate through 360 deg. for ten revolutions, and which

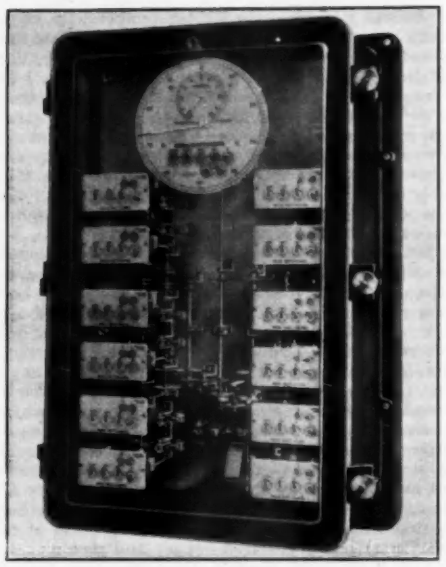

FIG. 6—SUMMATOR

travels over a larger dial so that one complete revolution corresponds to one division on the 300-deg. dial.

In this way the total length of scale available for reading is increased and with the large—360-deg.—dial divided into, say, 100 divisions the 300-deg. dial is in effect divided into 1000 divisions, giving a great scale length and fine subdivision with only two pointers. The clutch, which is of substantial design and which has been adopted to avoid the possibility of tooth-engaging errors, consists of two coaxial discs having cork-leather material on their opposing faces. Normally, the discs are pressed into contact so as to connect the summator rod movement with the pointers, but, on the receipt of an impulse at every given period from a time switch, an electro-magnetic device releases the clutch and a spring resets the drive to zero, the pointers remaining in position. When required, these pointers can be reset by hand from outside the case. In order to avoid backlash, which is often a serious trouble in commercial maximum demand indicators, a spring drive is provided for the pointers; it is wound up or reset by hand and provides the major portion of the energy to drive the pointers, thus reducing the energy required from the impulsing mechanism. To facilitate inspection whilst operating in service, the whole of the apparatus is mounted on a plate which is fixed to the case by hinges on one side and screws on the other, and on the removal of the screws the plate can be swung forward so as to expose the back connections, which are not disturbed in the process.

The printometer shown in Fig. 5 is an instrument which at predetermined intervals governed by a master clock records on a roll chart the demand which has occurred in an electrical circuit or circuits between each pair of successive intervals. It is operated from meters fitted with contacts associated with the recording mechanism in such a way as to cause electrical impulses to be sent to the printometer proportional to the energy metered in the circuit or circuits concerned, and each impulse consequently represents a given number of kWh or reactive kVAh. The magnitude of the impulses is constant, and they are received over three wires from two pairs of contacts, one wire being common to both the impulsing circuits, each circuit being used alternately. In the case of a single main circuit, the printometer is operated from one meter fitted with contacts, whilst in the case of more than one

circuit individual meters on each circuit transmit their impulses to a summator which sums the readings of the meters and transmits, to the printometer, impulses representing the energy summed.

The operation of the printometer mechanism is as follows: (1) The impulses received are integrated on a counting mechanism during a predetermined period, usually half-an-hour; (2) at the end of the period an impulse is received from the master clock, the integration ceases, and the counting mechanism remains at its setting at the time of the clock impulse; (3) the drive from the impulsing mechanism to the counting train is temporarily transferred to a spring storage device; (4) the motor energised from a local supply through a relay operated by the clock impulse drives a system of cams and rollers which causes the counting mechanism to print its value on a paper chart through a carbon ribbon; (5) after printing, the counting mechanism is reset to zero by the motor and is then ready to commence the integration of the impulses transmitted during the next period; (6) on completion of the resetting, the drive from the impulsing mechanism is restored to the counting train and the spring-storage device discharges into the train the revolutions stored during the printing and resetting period; (7) the motor is tripped out and the impulsing continues until a further printed record is called for by an impulse from the master clock, the printometer continuing to operate indefinitely as described, with an occasional paper refill.

The sequence of operations during a printing period after an impulse is received from the master clock is (1) the relay operates, releasing a brake from the motor and setting it in motion; (2) the transmission of impulses to the recording mechanism is transferred to the storage system; (3) prongs are inserted in the type rollers to align the printing wheels; (4) the carbon ribbon is moved in front of the printing wheels; (5) hammers fall, making a printed record on the paper; (6) the prongs are removed and the printing wheels are reset to zero; (7) the contacts stored are discharged into the counting mechanism and transmission is resumed; (8) the carbon ribbon is notched forward and lifted away from the printing wheels; (9) the chart is moved forward ready for the next impression, and finally the motor is disconnected and the brake applied to it. The printometer gives a positive indication of demand in four printed figures without the use of constants, and on the assumption that the scale can be read to one-tenth of an inch, the record is equivalent to a scale of 1000in. No ink is needed, a vernier is not required, and there is no loss of accuracy owing to contacts lost during the printing and resetting periods, whilst noise and vibration are reduced to a minimum.

## Aircraft in Paris.

A BREAK last year in the annual series of Paris aircraft exhibitions was due to the unsatisfactory condition of French aviation which had fallen so far behind progress in other countries that it was deemed desirable to postpone any further manifestation of the industry until it had been re-organised. That was the task of the new Air Ministry, and the work already accomplished has enabled French manufacturers to make up a good deal of leeway. The exhibition, which was opened last week in the Grand Palais, Paris, was, therefore, interesting, because it indicated the trend of French effort and the position now occupied by the French industry with regard to the foreign. After a lapse of two years, it must be admitted that the position has been considerably improved. The industry had been hampered by its dependence upon military requirements, and it was only when the importance of civil aviation showed the necessity of specialising in new types of machines, and means were provided for doing this, that any real progress began to be made. Old methods had to be abandoned, and most firms found themselves obliged to make a new start by adopting foreign ideas. There is, consequently, nothing new in the technical aspect of French aviation. It is still feeling its way, and the many different types of machines produced is regarded by the Air Ministry as an impediment to the commercial development of the industry, for which reason it is endeavouring to limit the number of types.

Air liners are required for services to South America, Madagascar and Indo-China, and the machines exhibited for that purpose were amongst the most interesting in the Show. In a general way, they were all metallic, built up with aluminium corrugated sheet and welded tubes, to the exclusion of wire stays, and there is a tendency to employ three engines on the big passenger-carrying aeroplanes. The wings are generally of thick section, and, in some, the engines are built into them. This has been carried, as far as possible, in the Couzinet design, in which the central engine is in the fuselage and the lateral engines in the plane, all being covered in, so that the machine is practically one plane offering no projections of any kind. A similar arrangement is found in the "Amiot," constructed in one of a number of factories that have been merged into one company. In contrast, there is the Bleriot monoplane with fuselage carrying engines fore and aft, and two spacious cabins suspended from the plane, one on each side. Questions of stability and convenience are of more importance than a little extra speed.

The Dornier S type of machine at the Paris Show afforded an interesting comparison with what is being done by French makers to produce seaplanes for passenger services. There is some similarity between the German seaplane and certain French machines. This may be explained by the fact that the French had long neglected the construction of suitable machines for flight overseas, and when the building of seaplanes became urgent, makers allowed themselves to be influenced by what was being done abroad, the more so because their own experiments had not always produced the best results. The flying boat "Cama," constructed by the Chantiers Augustin Normand, is designed to carry twelve passengers, and is propelled by two engines of 300 H.P. each, above the plane. The Société Aérienne Bordelaise showed a machine of a different type to carry 28 passengers. It has two fuselages connected by a cabin forming the central part of the plane, with a wing extending on each side. This design has been evolved from a huge experimental machine, which was built in view of the South Atlantic service and came to grief during its trials. Another South Atlantic machine is that of Liore and Olivier, with a very big boat fuselage between an upper plane and a lower short plane. It has four engines of 2600 horse-power carried in cabins on the sides and fixed between the planes. Its weight is about 17 tons and it is declared to have a radius of action of 2500 miles. There were other seaplanes, such as the "Latécoère," which have been in regular service to North Africa for years past, but apart from them, and they belong to the older methods of construction, the French have no seaplanes yet on regular lines. From what was seen at the Show, it appears likely, however, that suitable machines will be crossing the South Atlantic at a comparatively early date.

Another feature of the Paris Show was the attempt to popularise the touring aeroplane. An active propaganda is being carried out in France in favour of encouraging private aviation and creating an "air sense," which will stimulate air travel and thereby assist in the development of the aeroplane industry. The State grants substantial subsidies to clubs for the purchase of machines, as well as to private owners. It is hoped in this way to create a practically unlimited supply of pilots. Until now, all the small private areoplanes used in France have been of British construction. The Moth machines are now built by Morane-Saunier, and two or three small aeroplanes are supplied by French firms, particularly Farman and Potez. At present the interest in private flying in France is very small as compared with that in some other countries. The Italian section was devoted almost entirely to types of small private machines. The British industry was represented mainly by engines exhibited by Rolls-Royce, Bristol and Armstrong-Siddeley, and there were stands by Armstrong-Whitworth Aircraft, Ltd., and Vickers (Aviation), Ltd.

The radial air-cooled engine still holds its own, though there appears to be a greater use of water-cooled engines for the higher powers. Many countries exhibited aircraft engines, including Spain. In France, efforts are being made chiefly in the direction of designing aircraft engines to run on heavy oils. The State Aircraft Research Department has been working on this problem for a considerable time with the aid of a well-known engine expert, and it is declared that the Clerget engine, with solid fuel injection, is now quite satisfactory. It has nine radial air-cooled cylinders, develops 200 horse-power and weighs 310 kilos. It was shown in the section organised by the Air Ministry, where were also seen some results of technical and scientific research carried out on behalf of the State. Much of it was interesting, such as the method of showing fluid motion in a rocking glass globe in which a propeller is revolved. Investigators are chiefly concerned in discovering means of ensuring greater safety in flight and in preventing accidents from stalling and loss of speed. After all, the greatest security lies in the sound design and construction of the machine and engine.

## American Engineering News.

### Large Hydro-electric Generators for Russia.

FIVE additional large hydro-electric generators are to be added by the Union of Socialist Soviet Republics to the four machines already under construction in America for the Dnieper River development at Kichkas, near Zaporozhie, in the Ukraine. The first four generators are being built at the Schenectady works of the General Electric Company of New York, and the fifth will also be entirely constructed there. The remaining four will be manufactured jointly at Schenectady and in the U.S.S.R., with assembly of the units in Russia. The generators, which are rated at 77,500 kilovolt-ampères each, will be the largest water wheel driven generators of any type ever built. The next largest, those at Niagara Falls, are rated at 65,000 kilovolt-ampères each. While the Schenectady works of the General Electric Company of New York is constructing the generators, the Pittsfield, Mass., works is building twenty-one 26,000 kilovolt-ampère transformers, and the Philadelphia works the switchgear equipment for six units. The first generator is scheduled for shipment next April. The total weight of each unit will be about 1,760,000 lb.; the weight of the rotor and shaft will approach 980,000 lb. The maximum diameter will be 42ft., and the overall height 40ft. 5in., with 17½ft. extending above the floor of the plant. Fabricated, welded construction is being used, so as to eliminate large castings. The stator is being made in six sections, with the punchings and windings assembled in each section before shipment, and the rotor will also be dismantled for transportation. The two largest pieces will require special handling for shipment. They include the upper bearing bracket, 16ft. in diameter, and the steel shaft, 36ft. long and 40in. in diameter, with a 79in. flange on each end, and weighing about 136,000 lb. The nine water turbines, which are to operate under a head of 123ft., are being supplied by the Newport News Shipbuilding and Dry Dock Company. Messrs. Hugh L. Cooper and Co., New York, are the consulting engineers for the construction of the dam and power station.

### A Large New Hydro-electric Power Station.

On the morning of Tuesday, September 30th, President Hoover turned a golden key in the White House and put into operation the largest hydro-electric plant which has been completed in the United States this year. The electric current to effect the starting travelled over a special 700-mile circuit to the upper Connecticut River midway between St. Johnsbury, Vermont, and Littleton, New Hampshire, where the extensive Fifteen Mile Falls Lower Development has just been completed by New England Power Association, a subsidiary of International Paper and Power Company. This development is one of the biggest construction undertakings in New England's history. The main dam rises 175ft. above the bed of the river. On the Vermont side is the spillway, 850ft. long, and varying in height from 20ft. to 85ft., which leads to the main part of the dam, on top of which is one of the biggest transformer banks in that section of the country. At this station the electrical energy, which will be generated at 13,800 volts, will be stepped up to 66,000 volts for local distribution and to 220,000 volts for transmission over the 126-mile double-circuit steel tower line, which runs to a new switching station at Tewksbury, Massachusetts. Beyond the intake section is an earth dam, anchored wth the largest concrete retaining wall ever built in the United States. This wall extends 500ft. upstream and 395ft. downstream from the centre of the dam, is 175ft. high at its mid-section, and contains 90,000 cubic yards of concrete. The power-house is built in the river directly below the dam. The main building is 236ft. long and 99ft. wide. The generator room contains four vertical type generators, directly connected to the water-wheels. Each unit is capable of developing 54,000 horse-power.

### Welded Steel Buildings.

In about four years the construction of steel-frame buildings by welding instead of riveting the connections has developed to such an extent that welding is now used for very large and tall structures. From buildings of four to six storeys it extended to those of twelve and fourteen storeys and has been used recently in a nineteen-storey office building at Dallas, Texas, this building being 100ft. square and having about 1300 tons of steel. All this work was done in six weeks, the erection gang being closely followed by a welding gang composed of five men. The floor panels average 25ft. square. The lower storeys are 21ft. high and the others 10ft. to 12ft. from floor to ceiling. The steel columns are in two-storey and three-storey lengths, with spandrel girders welded to the outer faces of the wall columns. Brackets welded to the spandrels carry shelf plates to support the exterior masonry enclosing walls, these walls carrying no load. As the framing was erected it was put together with temporary bolt connections and was kept square and in plumb by means of cables adjusted by turnbuckles. The design was arranged to provide for a maximum of shop welding and to eliminate practically all overhead welding in the field. For the erection a steel derrick with 80ft. jib, operated by an electric winch, was used. Columns had splice plates shop-welded to the top, the projecting portions of these plates having holes for erection bolts. Brackets welded to the flanges and webs of the H-section columns support the floor beams, which were held in place by clips until the welding was done. As these floor beams take the wind stresses, they are connected into a continuous framing by plates outside of the columns and welded to the top and bottom flanges of adjacent beams, which are rolled steel joists.

### Coal Storage at Coke Works.

To serve its blast-furnace plant near Chicago, the Youngstown Steel and Tube Company has established a large by-product coke plant heated by blast-furnace gas and producing daily 18 million cubic feet of coal gas, which is sold to an illuminating company. There are seventy ovens of 16½ tons capacity. For this plant a daily supply of 1400 tons of coal of high volatility and 400 tons of low volatility is required, all coal being delivered by steamers and handled by an unloading machine. As navigation is closed for about five months in the year, a coal storage yard 400ft. by 800ft. with capacity for 250,000 tons of coal stacked 35ft. deep has been established at the wharf. At present only half that area is in use. The unloading machine delivers the coal to electrically-operated railway cars, which discharge it into a track hopper from which it is carried by an inclined stocking conveyor, which, in turn, discharges it in a pile within reach of a scraper bucket of 7 cubic yards capacity, operated by cables. This scraper distributes the coal over the area of the yard. To supply the coke ovens, this same scraper carries the coal to a pit, from which an inclined conveyor elevates it to a bin in a steel tower spanning a railway track. Electrically-operated hopper cars finally carry the coal to the coke plant. About 250 to 270 tons an hour can be loaded in this way. Around the yard is a track of 18ft. gauge, on which travel two steel towers 30ft. high, to which the operating cables are attached, the third point being a fixed tower or head post at one side of the yard, surmounted by a cabin for the operator who controls the movements of the bucket by means of the electrically-operated cable drums. The hauling cable leads directly to the bucket. The back-haul cable leads to the two tail towers and then back to the rear of the bucket. Fairlead blocks with 30in. sheaves provide for easy movement of the cables in handling the bucket.

### Concrete Crib Retaining Walls.

A type of retaining wall construction which is coming into extensive use on American railways, although it has been developed only within the past ten or twelve years, consists of a crib-work of rectangular cells built up of precast concrete members dowelled together like timbers. These cells are filled with earth as the cribbing rises. Besides various commercial forms of these concrete "timbers," several railways have designs of their own. Most of them have an interlocking feature, but in some cases they are simply rectangular blocks about 8in. square and 6ft. to 10ft. long, with cored holes in which dowel rods are inserted and grouted. They are of two distinct classes, one forming an open face cribbing, where headers alternate with stretchers. In the other, a solid face, which requires some drainage of the filling, is formed. The height rarely exceeds 16ft. Practically no foundation work is required, simply the removal of loose top soil and levelling a surface for the first course. The construction can be done by unskilled labour rapidly and economically. It may be done either by contract or by railway forces. Care is required in the filling, or the pressure, as with swelling clay used in some cases, may cause the wall to shift or bulge. In the interlocking designs, also, the interlocking parts must have sufficient strength not to crack or break under ordinary pressures. In some cases, where changes of line have made it necessary to raise existing retaining walls, the extra height has been built with the crib construction. These walls are used in both cuttings and embankments, and for the embankment approaches to railway and roadway bridges. The cost is from a third to half that of a monolithic wall for the same position.

## The Magnetic Separation and Sieving of Foundry Sand.

DURING a recent visit to the works of the Rapid Magnetting Machine Company, Ltd., of Magnet Works, Lombard-street, Birmingham, we inspected some interesting plant for the magnetic separation and sieving of used foundry sand. Even in this economic age, many responsible for the working of foundries do not, in the opinion of the makers of this plant, realise the amount of money that is continually thrown away in foundry refuse. It is not unusual, they explain, to see being taken to the dump, tons of used foundry sand containing a large percentage of iron in the form of spillings, gits, shot, &c., not to mention nails and brads, which could have been re-used many times. Whilst in some cases the refuse sand may have been handled twice by a labourer, who may have removed all the iron, &c., he has observed, this system of recovering, it is pointed out, is inefficient and costly, owing to the labour charges involved, whilst small iron is overlooked and finds its way to the dump. These conditions are not so apparent in large foundries as they are in small foundries, where the saving may not be considered great enough to be worth consideration. Possibly those associated with the small concerns have only judged the resultant saving from tests made by separation by the human element, and it may have been found that the labour costs compared with the amount saved are so high that the problem is put aside without attention being paid to the possibilities of mechanical handling and magnetic separation.

The Rapid Magnetting Machine Company supplies several types of electro-magnetic separators for dealing with used foundry sand, and suitable for use in large and small foundries. The firm has found it convenient to attach to the framework of these magnetic separators a jig-shaken sieve, placed high enough to enable it to discharge the sieved material directly into a bogie wagon or similar contrivance. The illustration, Fig. 1, shows an improved electro-magnetic drum, 24in. in diameter, known as the "A A" type, and consisting of a stationary magnet unit around which rotates a mild steel cover. The used foundry sand is fed on to the top of the drum, preferably by a jig-shaken feed tray. The iron is held to the mild steel cover, is carried round and released automatically at the back of the drum, whilst the clean material falls forward by gravitation. This type of separator is made in any width up to 48in., and is particularly suitable for fitting into existing plant. In the event of the existing plant containing a belt conveyor, the terminal head pulley can be replaced by a pulley type electro-magnetic separator, as shown in Fig. 2. In this case the magnetic material is retained on the belt until it is carried out of the magnetic field.

The two arrangements for the separation of iron from used foundry sand are shown in Figs. 3 and 4 respectively. In the case of the plant shown in Fig. 3, the used sand is fed through a grid attached to the boot of the bucket elevator, and is discharged on to a type "A A" electro-magnetic drum. The iron is discharged down a back chute, whilst the sand is sieved and any over-size material, such as wood and other foreign matter, is discharged at the end of the machine, which therefore gives three products—the iron nails, gits, &c., all of which can be used again; clean sieved foundry sand suitable for mixing with new sand; and oversize material, which can be taken direct to the tipping dump. Owing to the mixed material being handled only once, it is possible for one man to operate the machine, which will deal with from 2 to 3 tons per hour.

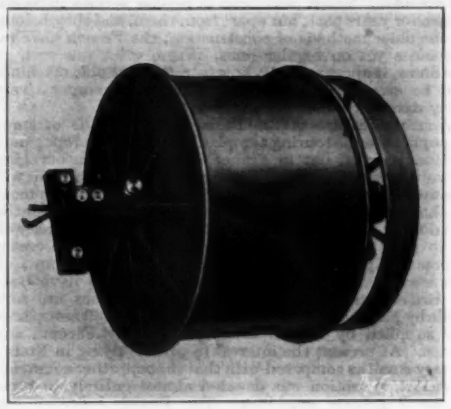

FIG. 1—DRUM SEPARATOR

The working of the machine shown in Fig. 4 is identical to that just described, but a band conveyor and pulley-type separator are employed instead of the bucket elevator and "A A" type drum. Both machines are capable of dealing with 3 tons per hour, the cost of running at that output being, it is said, less than 2d. per hour. For use where refuse foundry sand, prior to being discarded, is separated from its iron content only, the firm has supplied a number of self-contained machines, as shown in Fig. 5, which is self-explanatory. This machine will deal with from 4 to 5 tons per hour and its initial cost is low.

Another type of machine for handling foundry sand is shown in Fig. 6. In this particular case the iron is separated before sieving. The magnets are stationary and encircle half the extension of the screen, and feelers inside this extension are magnetised by induction and carry the iron from the foundry sand to the top of the screen, where it is discharged down the chute. This screen type of separator is mainly intended for foundries with outputs of 8 tons per hour and over.

Although the firm has produced many standard designs of plant for the combined separation and sieving of foundry sand, it is always prepared to submit special designs to meet individual requirements. In some cases it has been found advisable to convey the treated sand direct from the sieve into the mill by means of a band conveyor or alternatively to a storage bunker by means of a bucket elevator. Sometimes the plant is situated 15ft. or 20ft. from the floor, which enables the floor space beneath the machine to be used to the best advantage. It is quite usual to install the mill beneath the sifter, when the material is discharged direct from the sifter to the mill by gravity. The firm also specialises in the manufacture of complete foundry sand-handling equipments for the larger foundries, and has many interesting designs based on the experience of many foundry engineers.

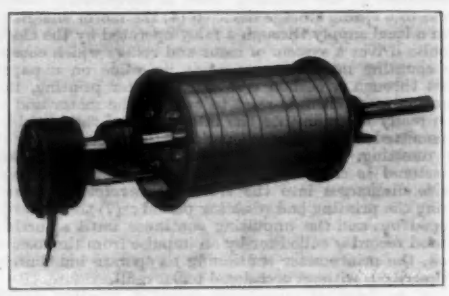

FIG. 2—PULLEY SEPARATOR

FIG. 3—ELEVATING, SEPARATING AND SIEVING PLANT

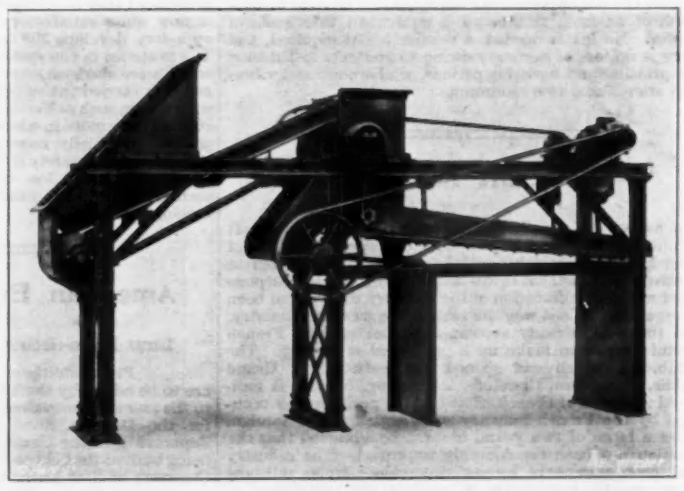

FIG. 4—BAND CONVEYOR SEPARATING AND SIEVING PLANT

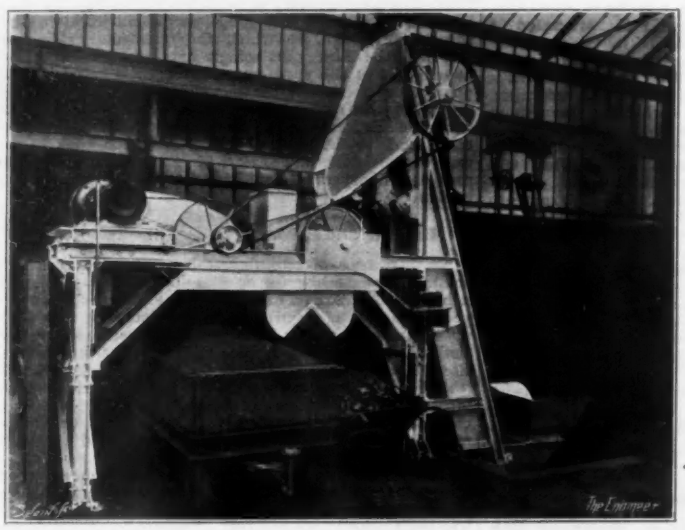

FIG. 5—ELEVATING AND SEPARATING PLANT

FIG. 6—SCREEN-TYPE SEPARATOR

INTERNATIONAL ALUMINIUM COMPETITION.—We are requested to announce that all communications concerning the International Aluminium Competition, which is designed to encourage suggestions for increasing the use of aluminium and aluminium alloys, should be addressed to the Bureau International de l'Aluminium, of 23 bis, Rue de Balzac, Paris, France, and not to the British Aluminium Company, Ltd.

# Water Supply Problems in Holland.*

By F. A. LIEFRINCK, Engineer, Government Bureau of Water Supply, The Hague, Holland.

As is well known, the inhabitants of the Netherlands never have had much reason to complain of lack of water; on the contrary, water has been their greatest enemy ever since the first settlers chose the delta of the rivers Rhine, Meuse, and Scheldt for their future residence.

Unfortunately, most of this water, being either salt, brackish, or polluted, is not fit for consumption; and as geo-hydrological conditions are unfavourable, great difficulties were, and still are, encountered in providing fresh and potable water for the steadily growing population, which at present numbers 7·7 millions. In this article, some aspects of the country's "struggle for water" will be briefly dealt with.

FIG. 1—MAP OF HOLLAND SHOWING DISTRIBUTION OF WATER SUPPLY UNDERTAKINGS

## SOME FACTS AND FIGURES.

The oldest waterworks in Holland are those of Amsterdam, situated in the dunes south of Haarlem, which were finished in 1853 by English engineers, and for a few years were run by an English company. Three years later Helder followed suit, also taking its water from the dunes. In 1874 the river waterworks were opened in Rotterdam, which at present furnish water to Delft, Schiedam, and Vlaardingen also, and The Hague obtained a dune water supply; Leiden in 1878, Utrecht in 1883, and other towns and communities following in rapid succession. The towns and districts which have a central water supply and the works under construction are indicated on the map, Fig. 1.

According to the latest statistics at hand, 4·7 million inhabitants out of a total population of 7·7 millions, or 61 per cent., divided over some 444 communities, are now supplied with water. Of these, 142 use water drawn from the dunes, 253 take ground water outside the dunes, and 49 have a river water supply, some of them, like Amsterdam and Groningen, distributing both river and ground water. In 1929 there were 148 different water undertakings, 109 of which were run by public administrations and 39 by private corporations.

Water undertakings in rural districts in most cases are built by a combination of several communities, generally organised as a "corporation" or "limited liability company." The province of North Holland has, since 1919, run her own district supply, at present the largest in the Netherlands, covering 104 communities. Other rural districts having a central water supply include South-Beveland, erected in 1912, 24 communities; Tholen, 1923, 7 communities; Westland, 1923, 5 communities; North-West Brabant, 1923, 25 communities; Leeuwarden-district, 1925, 14 communities; Kilwaterleiding, 1926, 9 communities; South Limburg, 1927, 27 communities; West Utrecht, 1927, 5 communities; North-West Utrecht, 1928, 20 communities; Tien Gemeenten, 1928, 12 communities; Schouwen-Duiveland, 1930, 16 communities. District supplies for North-Overijssel, 22 communities, and the Province of Groningen, 40 communities, are in preparation or under construction.

The daily *per capita* consumption in Holland in 1928 averaged about 20·8 gallons. This low figure may be due partly to the fact that industrial undertakings generally have their own sources of supply; but the rural population, which for centuries has been obliged to economise in potable water, is not extravagant in the use of a piped supply, even if no meters are installed—as is generally the case with rural supplies—while meters on city supplies discourage waste. The average daily figures for 1928 for some of the largest towns run as follows:—Amsterdam, 24·32 gallons; Rotterdam, 25·1; The Hague, 15·4; Utrecht, 20·75; Groningen, 18·26 gallons. Water rates generally range from 20 to 50 cents per 100 cubic feet for domestic purposes.

## THE GOVERNMENT AND WATER SUPPLY.

To advise the Government in questions of water supply, a Governmental Commission was installed in 1910; and in 1913 its annexed technical bureau was transformed into an independent service, the Government Bureau of Water Supply. This Bureau draws up plans for and promotes the construction of rural supplies; it controls the State-subsidised undertakings; its services are also available for provincial and municipal authorities, as well as for private persons and corporations, for carrying out technical, chemical, and geo-hydrological investigations and valuations. It also undertakes the direction and supervision of works under construction; all against reimbursement of actual cost. The Bureau further collects and examines data bearing on soil and water; over 18,000 reports on borings, 30,000 boring samples, and 9000 water analyses are now available. The results of its studies are published at irregular intervals.

To encourage the construction of waterworks, especially in rural districts, the Government not only contributes towards the cost of plans, but often takes over the financial risks of new enterprises, thus practically safeguarding the community shareholders against any financial difficulties.

All questions regarding the hygiene of "water, soil, and air" were, by the Public Health Act of 1901, put under the control of the "Inspectors of Public Health"; while a central laboratory, established in Utrecht, yearly examines the water of all waterworks in Holland chemically and bacteriologically.

## THE GEO-HYDROLOGICAL CONDITIONS.

The greater part of the country is of a lowland character, only a few spots rising more than 300ft. above Ordnance Datum (N.A.P.=Amsterdam level). The level of 1 m. (3ft. 4in.)+N.A.P. has been indicated on the map—Fig. 1. West and north of this countour line the land would be submerged at high tide and by every flood in the rivers, but for the dunes and dikes.

These dunes were formed by the wind on the sandbanks which had been deposited in a shallow part of the sea, thus creating a so-called "haff." The original salt water in this haff was gradually replaced by fresh; sand and clay filled the lake, and moorland vegetation grew up, which later originated moors and fens. As the line of defence was interrupted at several places by the outlets of continental rivers, and was broken by heavy gales, inland seas like the Zuyder Zee, river deltas, and islands were formed, while a general settling of the land—or, as some put it, a rise of the sea level—contributed towards the necessity of constructing sea defences.

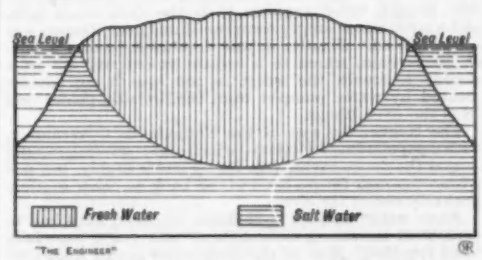


FIG. 2—DIAGRAMMATIC SECTION OF DUNE

In the pleistocene and holocene periods, during the inundations, the different layers of the soil were impregnated with salt or brackish water. But in the dunes, where the rain readily could percolate, this salt water gradually was replaced by fresh, thus forming the typically lens-shaped fresh water accumulations, schematically shown in Fig. 2. This phenomenon, resulting from the different specific weights of salt and fresh water, was first observed by the Dutch military engineer Badon Ghyben in 1889, and twelve years later was confirmed by the investigations carried out by Herzberg on the island of Norderney, Germany.

These fresh water supplies, being limited, have to be handled in the most economical way, and special attention has to be devoted to preventing a rising of the salt water level, which in several parts is to be found at some 350ft. below N.A.P.

The Castricum pumping station of the North Holland water service uses the deep layers exclusively, impermeable strata below the fresh water in this locality protecting it against a rise of the brackish zone. The Leiden and Amsterdam works and the other dune waterworks only partly use the deeper layers, and mainly take their water higher. This water is captured either by means of shallow wells—Haarlem—by open channels—Amsterdam—or by covered drains—The Hague.

Thanks to the investigation of Mr. Pennink, late director of the Amsterdam waterworks, and others, a clear insight has been obtained into the rather complicated hydrological conditions of this part of the country, in which at present over two million inhabitants find their source of supply.

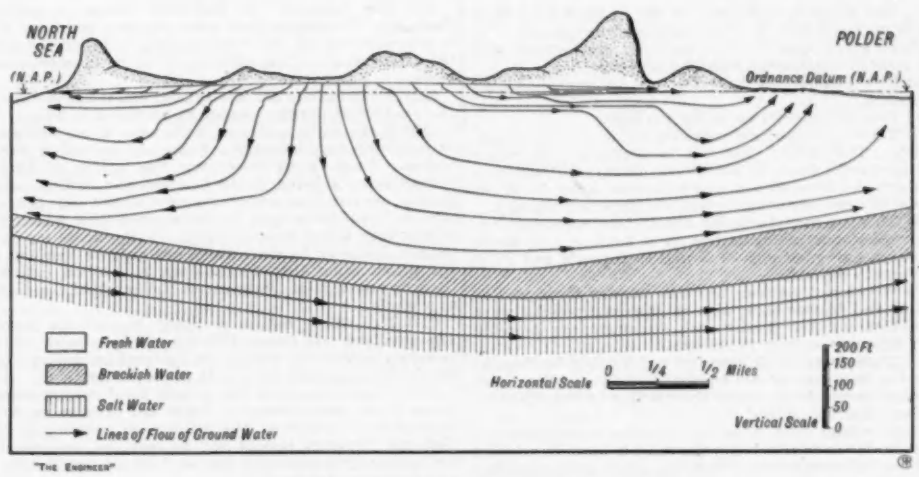


FIG. 3—SECTION OF DUNES NEAR SCHOORL

The results of investigations carried out by the Government Bureau of Water Supply in the dunes near Schoorl are shown in Fig. 3. (It should be noted, that in this drawing the horizontal scale is one-tenth of the vertical scale.) As may be gathered from this figure, part of the dune water flows off landward towards the polders. By the layers of peat it encounters it is often rendered unfit

* Abridged from *Public Works*, September, 1930.

for consumption, however, and the inhabitants in these districts have to depend on rain water, except where a piped supply has been established.

Conditions are a little more favourable in the eastern part of the Netherlands, where are found pleistocene sands and gravels, which, if protected by layers of clay, yield water of excellent quality. Generally these ground waters require deferrisation and demanganisation. In some cases, however, they are distributed without any previous treatment—Utrecht, Arnhem. Several waterworks use the deeper pleistopliocene strata, taking the water at a depth of 250ft. to 300ft.—Nijmegen, Assen—while in North Brabant some works draw from wells sunk into the marine upper and middle pliocene and miocene formations, at a depth of 350ft. and more, which layers yield a water of greater hardness than that from higher lying strata, which is rendered as soft as possible, but has no accompanying aggressive properties.

In the southern part of Limburg water is often drawn from the chalk formations—Heerlen—while towns along the river Meuse—Maastricht, Sittard, Roermond, Venlo—utilise the pleistocene sand and gravel terraces, which generally carry water abundantly.

### SOME PROBLEMS OF TO-DAY AND TO-MORROW.

With a population of some 750,000 and rapidly increasing, Amsterdam, which also supplies the surrounding communities with water, has for several years been faced with the necessity of finding other sources of supply, the existing sources—the dunes at Leiduin, a ground water station near Hilversum and a canal water station at Weesperkarspel—having reached their maximum capacity. Proposals were made to irrigate the dunes by river water, elaborate investigations were made of the possibility of new ground water supplies from the Gelderland hills, and a river water supply from the Rhine near Rhenen was contemplated. Finally, it was decided to utilise a lake at Loenerveen, which to a certain extent will act as a storage reservoir, the water in the lake being supplemented by water pumped from the Bethune polder and from the river Rhine.

The Hague, the seat of the Netherlands Government, with a population of 450,000—which also is growing rapidly—uses the dunes exclusively for its water supply, but will within the near future have to fall back on other sources, probably one of the rivers.

River water supplies in Holland, however, have had to cope with increasing difficulties of late years, especially taste troubles. Most of the river water comes from Germany, through the Rhine, and tastes noticed at Rotterdam—at present supplying water to a total population of some 740,000—were supposed to originate in the mines and blast-furnaces of the Ruhr district; although some ascribe them partly to actinomyces and other organisms. Ozone and other treatments proved ineffective, but filtration through "Norit" activated charcoal removed the odour, and charcoal filters are now being installed permanently.

Future problems of a different kind arise in connection with the reclamation of the Zuyder Zee, which is now in full swing. It will add some 550,000 acres of fertile land to the country. One of the four polders—the N.W. one—will be ready for occupation by 1931.

The soil of these new polders having for centuries been saturated with salt water, there is not much hope of finding fresh ground water for the population which may be expected to settle there. Schemes are already being worked out providing for a water supply from the neighbouring provinces. It is further hoped that the Yssel Lake, which will be left between the four polders, may, after some lapse of time, contain fresh water brought into it by the river Yssel and other small streams.

## British Engineering Industry.

### REALITIES AND PROBLEMS.

CONCLUSIONS embodied in a pamphlet issued by the Engineering and Allied Employers' National Federation, Broadway House, Tothill-street, S.W. 1, November, 1930.

(1) The principal industries of the country have been briefly reviewed and their present position explained.

(2) In every case there is declining employment and in competitive industries a decline in exportation.

(3) The country is experiencing an unprecedented depression.

(4) Production costs are much too high.

(5) There is immediate necessity for a national stock-taking. The degree that we in common with other countries suffer from the world-wide slump and the degree to which the depression in our industries is due to causes special to ourselves are questions of compelling urgency.

(6) This is a manufacturing country and upon the continuance of our manufactures in a healthy and stable condition our greatness as a nation depends and must continue to depend.

(7) We cannot contemplate this country if reduced to trading and finance being able to support a population of 46 million people. Under such circumstances it would with difficulty support 18 millions.

(8) These facts are elementary, and it might be thought that the first care of our legislators, keeping these facts in mind, would be to frame their policy in the direction of the conservation and development of industry, or, at least, to refrain from impeding industrial development.

(9) So far from this being the case, it must be realised that for the last two decades sentiment and sentimentalism rather than reason have been the mainspring of domestic policy.

(10) The industrial ignorance of political parties in this country, and the readiness with which they have from political motives added to the burdens on industry, is illustrated by the fact that during the last 40 years social burdens have increased by about 1500 per cent.

(11) In vain have protests been made as to the inevitable result of such a course; in vain has it been urged that the cumulative effect of such burdens and their accompanying administrative expenses must sooner or later result in a declining industry and a bankrupt Treasury.

(12) It is, indeed, time that we faced facts. Democracy, instead of being bribed by promises and benefits, must be told the truth.

(13) The passion for making royal roads for everyone from the cradle to the grave must give place to the consideration that in a well ordered State, the conception of the State as a fairy godmother is a fundamental fallacy.

(14) The prosperity of a people depends on their own exertions and the measure of that prosperity must govern any State benevolence.

(15) The example set by the State in the matter of extravagance has served as an encouragement to local authorities.

(16) Such extravagance, national and local, is draining the country of money and is engendering in the people a feeling of false security which is being translated into apathy.

(17) A nation such as ours can stand being told the truth and can be depended on to follow a clear call to their intelligence and energy to meet a national crisis. That a crisis exists cannot be denied.

(18) Economy in Government, economy in municipal and local administration is urgently necessary.

(19) Industry, as the patient beast of burden, is on the verge of collapse. The responsibility for the continuance of the present burdens is grave indeed.

(20) The Engineering Industry is a finishing industry. In the purchase of its materials, it has to carry burdens accumulated in every branch of industry contributing to the supply of these materials—coal, iron and steel, transport, &c.—as to wages, local rating and national taxation.

(21) The Industry is, therefore, under a twofold disability. It has to look after its own economy and it has to accept all the "pre-charges" created for it by the earlier stages of manufacture even on an uneconomic basis.

(22) All industries are interrelated and it is the duty of all to contribute to the solution of present difficulties.

(23) Particularly is this so in the case of the sheltered, or non-exporting, industries, municipal and other public bodies. These, being freed from the burden of foreign competition, or being in the position of spending public monies, are not conscious of the cares of economic production and pay little heed to the sources from which the money they spend must be found. They create for competitive industry burdens which can only be justified by the presumption that they occupy a position entitling them to preferential treatment at the hands of the nation as a whole.

(24) The whole nation is living beyond its means. The standard and mode of living which have grown up in recent years have outrun the national income and will require to be brought back to their proper relation.

(25) If any change in the present fiscal system should result in an improvement in trade and thereby create a new source of revenue, the amount so accruing to the National Treasury should not be regarded as available for further extravagances, but used for the liquidation of existing commitments.

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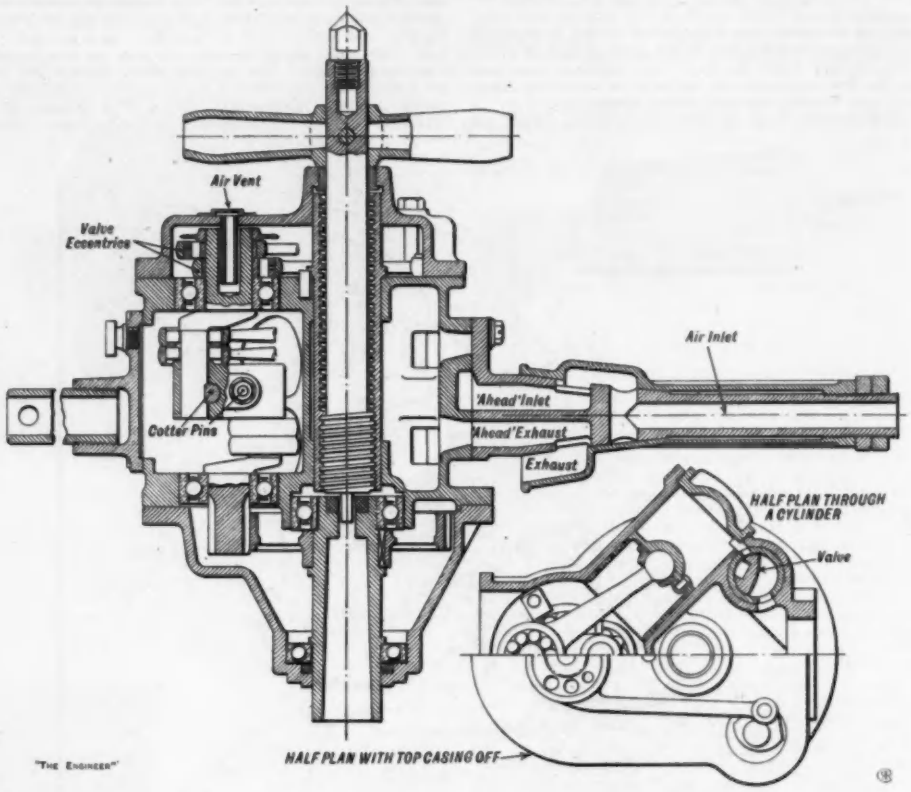
A NEW line of production has been embarked upon by the De Forest Crosley Radio Company, of Montreal, which has organised a subsidiary company under the name of the Hammond Company of Canada, Ltd., to manufacture for the Canadian market a new synchronous electric clock and allied products. This clock has come largely into use in the United States, and a special feature of it is that it is regulated every night from the central power station.

## FOUR-CYLINDER, ROTARY, PNEUMATIC DRILL

THE GLOBE PNEUMATIC ENGINEERING COMPANY, LTD., LONDON, ENGINEERS




## A New Pneumatic Drill.

A NEW design of rotary pneumatic drill, which we illustrate in the drawing herewith, has recently been brought out by the Globe Pneumatic Engineering Company, Ltd., of 1, Victoria-street, Westminster.

The engine of this drill is of the four-cylinder, single-acting type, and has some peculiar features. The cylinders, it will be seen, are set V-fashion, and by staggering them it has been found possible to bring the big ends of the connecting-rods of each pair of cylinders on to one crank pin, so that there are only two cranks, and it is not necessary to offset either the rods or the small ends. As a consequence, there is no side thrust on the pistons or the crank shaft. The crank shaft is built up of three pieces, as shown plainly in the drawing—two end pieces, each forming a shaft, a web, and a crank pin. The third piece is the common web, which is rather more substantial than usual. The crank pins are threaded into holes in this web and are held in place by cotters, similar to those used on cycle pedal cranks. These cotters are screwed at both ends, so that by taking off the nuts and screwing them on the opposite ends they may be used for pulling out the cotters. In this way it is made possible to assemble the crank shaft with the big ends in place, with standard roller bearings for all the rods. The main bearings for the crank shaft are of the ball type, as are also those of the drilling spindle. The driving pinion is machined out of the solid end of the crank shaft.

There are two air distribution valves, of the Corliss type, for the four cylinders, and they are driven by a pair of excentrics at the top end of the crank shaft. It is suggested that this is an improvement on the previous arrangement of putting the excentrics at the bottom, driving, end of the shaft, as it provides a better distribution of the load, while the oscillating movement of the valve gives a lower rubbing speed than the more common rotary valve. The pistons have a ball and socket arrangement for the small ends of the connecting-rods, which enables the pistons to rotate as they work, and so equalise wear. The two parts are held together by a hardened pressed-steel cap riveted in place. It is a simple matter to file off the head of this rivet and punch it out, if either the rod or the piston must be renewed.

It will be noticed that both the handles are attached to the casing by flanges covering openings. These openings greatly facilitate the coreing of the casting and provide convenient inspection doors. The scheme for venting the main casing has been improved and now consists of a tube fitted to the top cover and projecting into a hole drilled in the top end of the crank shaft. Compressed air, which may find its way past the pistons, will flow through the top crank shaft bearing on its journey to the vent, and will take lubricating grease with it. This grease will pass over the excentric straps and will lubricate them, but must also pass over the knife-edged grease thrower which holds the excentrics on to the crank shaft. As this part revolves at a very high speed, the grease will be thrown towards the valve cranks in the top casing, and thus be prevented from leaving the machine with the vent air. The placing of the vent at the top part of the machine is claimed to encourage a flow of lubricant to an area often starved in previous designs.

The engine is reversed by the usual expedient of changing the functions of the inlet and the exhaust by twisting the casing over the inlet handle. It is noteworthy that all the ball and roller bearings are of standard stock sizes, and that the valves, their bushes, the excentrics and rods, the connecting-rods and the pistons are all identical, so that a minimum of spare parts need be kept.

# Provincial Letters.

## THE MIDLANDS AND STAFFORDSHIRE.

*(From our own Correspondent.)*

### Quiet Trading Conditions.

THERE is a certain improvement in the tone of the Birmingham iron and steel market, but no extension of consumptive demand is in evidence. Producers and consumers are a little more optimistic, and are taking more interest in business, but it is difficult if not impossible to find anything more tangible than hope on which is based the expressed expectations of trade improvement. The iron, steel, engineering and other heavy industries, in the Midlands and Staffordshire, at any rate, continue in a depressed condition, and careful inquiries fail to reveal any improvement since the opening of the month. Not only so, but industrialists do not now look for any marked progress this year. They continue hopeful, however, that the year 1931 will see a real recovery which will put industry in this area on the right road to a return to the prosperity which once was hers.

### Steel.

Demand for finished steel is below normal, and specifications are disappointing. Orders being few and of small content, the position at the steel works is perplexing and mills are kept running with difficulty. Work in the structural engineering yards is no better than it was, and the requirements of the industry are small. Even the rolling stock establishments and the automobile engineering shops are not consuming as much steel material as they were. Prices are strictly adhered to, the Association basis being quoted on all occasions. Angles are £8 7s. 6d., tees £9 7s. 6d., joists £8 10s., ship, bridge and tank plates £8 17s. 6d., all subject to rebate. Boiler plates have weakened to the extent of half a crown per ton, £9 7s. 6d. being now accepted by district sellers. The subsidence of prices in various descriptions of uncontrolled steel has not had the effect of stimulating demand, but it has caused consumers to weigh more carefully the claims of native and foreign steel. That has been aided by the recent upward rush of continental prices, which has naturally stimulated inquiry by British users of imported iron and steel. That they have refused to follow the prices up suggests that there is no increase in consumption to support the movement. There is, of course, a wide margin between English and foreign values, and the latter are still low enough to attract business, if there was any considerable tonnage likely to be placed. The stiffening tendency of continental prices continues. German billets are no longer offered, and quotations have been withdrawn or made provisional in other directions. Belgian billets have changed hands at £4 10s., sheet bars £4 10s. to £4 12s. 6d., small bars at £5 10s., joists at a few shillings over £5, angles at £5 10s., and plates at £6. Values of English uncontrolled steel are much as a week ago. Small bars rolled from foreign billets are quoted £7 7s. 6d., and mild steel billets £5 12s. 6d. There is practically no call for scrap of which merchants hold large stocks.

### Staffordshire Bar Iron.

The Staffordshire finished iron trade remains much as a week ago. There has been no noticeable accession of business in any branch of the industry, and activity continues to be restricted to some three days a week. It is in rare instances that that time is now exceeded. Orders when received are for such small tonnages that it would need a large number of them to make up what, in normal times, would be considered even a reasonably good order. The makers of best grade iron are the best placed of ironmasters, and here there is a fairly regular call. The trouble is that it is for such small amounts and that the new business does not equal orders being executed, so that each week sees order books becoming thinner and thinner. Values are maintained at £12 10s., makers being of opinion that no useful purpose would be served by reducing them, even if this course commended itself to them, in the present state of consumptive demand. Crown bar makers secure an order here and there at prices ranging from £10 to £10 7s. 6d. per ton, but the aggregate of business is at best small. Producers of common bars for the nut and bolt and fencing trades are poorly employed. Their quotation of £9 per ton looks extraordinarily high when compared with the £5 7s. 6d. to £5 12s. 6d. quoted by their continental rivals. Except when native material is specified, the business goes to Belgium. Wrought iron tube strip sells moderately well at from £10 17s. 6d. to £11 per ton, but even in this department more material could be supplied if required. Ironmasters generally are disappointed with the volume of business going their way, and are eagerly searching for outlets for their production.

### Pig Iron.

After the slight spurt in buying of pig iron, as recorded in this letter last week, trade has settled down to hand-to-mouth buying on a similar scale to that which has prevailed for months past. It is obvious that the requirements of Midland foundrymen are small, for with prices stabilised until the end of January there is some incentive to make contracts over the next two months. Consumers in most cases, however, are content to buy a few tons at a time as required for current consumption. Prices stand unaltered, Derbyshire No. 3 foundry being £3 11s., forge £3 6s., and Northamptonshire foundry £3 7s. 6d., with forge £3 2s. 6d. per ton, delivered at Black Country stations. The recent price adjustment is believed to have checked further business with continental houses, despite the fact, reported this week, that continental pig iron suitable for local foundry work is being offered in the Black Country at £3 5s. 3d., 2s. 3d. less than the price of Northants No. 3. Reports from Cleveland indicate that Midland iron is competing in that district with the local brands. There is insufficient business, however, from all quarters to enable blast-furnacemen appreciably to lower their heavy stocks.

### Galvanised Sheets.

Business in galvanised sheets continues of a restricted character. There was some movement, especially on the part of consumers in the home trade, following upon the lowering of selling rates, but they have contracted as far forward as they consider expedient, and trade has reverted to the small-scale buying which prevailed previous to the fall in values. Overseas demand is very disappointing, and local millowners are only carrying on with difficulty. They are much in need of substantial orders. Values are as a week ago, on the basis of £11 5s. for 24-gauge corrugateds.

### Tin-plate.

The tin-plate trade is as dull in this district as before the price control was lifted. Sellers on 'Change in Birmingham this week quoted primes at 16s. and wasters at 15s.

### Power from Sludge Gas.

The sludge gas power plant erected by the Birmingham Tame and Rea District Drainage Board at Saltley has been such a success that a third gas engine has been installed. The power unit is now said to be the largest of its kind in existence. A report presented to the Birmingham City Council on Tuesday stated that the results obtained since the scheme was first adopted more than justified the estimates upon which it was based. When in 1928 the installation was extended, it was anticipated that the production of 1½ million units of electricity per annum would be effected with an annual saving to the Board of more than £2000 when compared with the Birmingham Corporation tariff for electricity; but the experience of the past two years' working has proved that it will be possible, with the gas collectors provided, to obtain an annual output sufficient to generate 2,000,000 units, with a largely increased saving. As the Board's consumption of current will shortly reach 3,000,000 units per annum, it was thought desirable to lay down a third gas engine and alternator, and that has accordingly been done. Thus, there are now installed at the Board's power-house three gas engines—with a total capacity of 950 B.H.P.—all operated by sludge gas.

### Tramway Contracts.

Two firms in the Midlands have successfully tendered to supply fifty new tramcars and an electrically operated car traverser for Leyton Borough Council. The Council has accepted the tender of the Electro-mechanical Brake Company, Ltd., West Bromwich, to supply fifty centre-bearing swing-bolster tramcar trucks for £13,225. To supply a car traverser, the tender—£425—of Messrs. Holt and Willetts, Cradley Heath, was accepted.

### Unemployment.

A further increase in unemployment in the Midlands area is shown in the latest returns, the present total of 297,190 being 494 in excess of the previous week's figures. Of the total, 204,212 are men, 5422 boys, 82,100 women, and 5456 girls. The figures for the principal towns are as follows:—Birmingham area, 51,557; Bilston, 4823; Coventry, 9359; Cradley Heath, 7825; Derby, 9711; Dudley, 5953; Leamington and Warwick, 1159; Leicester, 12,167; Northampton, 6854; Nottingham, 12,629; Oldbury, 2225; Peterborough, 1312; Redditch, 1548; Smethwick, 5262; Stoke-on-Trent area, 26,988; Stourbridge and Brierley Hill, 5494; Tipton, 3175; Walsall, 8532; Wednesbury, 3805; West Bromwich, 4436; Wolverhampton, 11,440; Worcester, 2280. It is worthy of note that slight decreases were recorded in the following areas:—Birmingham, Bilston, Coventry, Cradley Heath, Leamington, Warwick, Nottingham, Oldbury, Redditch, Wednesbury, Wolverhampton, and Worcester.

## LANCASHIRE.

*(From our own Correspondents.)*

MANCHESTER.

### Early Start on Mersey Flood Prevention Scheme.

THE Rivers Mersey and Irwell Catchment Board, which is now in process of constitution under the Land Drainage Act of this year, is expected to be in a position to hold its first meeting early in the new year. The Board will consist of representatives of the counties of Lancashire, Cheshire and Derbyshire, and of the County Boroughs of Manchester, Salford, Oldham, Bolton and Stockport, with four other representatives appointed by the Ministry of Health to represent internal drainage boards. The first important work of the Catchment Board will be to consider a scheme to prevent flooding of the river Mersey. Details of this scheme have already been prepared, and if, as is expected, the Board gives its approval to it, it is anticipated, by Sir George Etherton, Clerk to the Lancashire County Council, that the work will be started early next year. The cost will be in the neighbourhood of £150,000.

### Additions to Work.

Two Lancashire firms—Ferranti, Ltd., Hollinwood, near Oldham, and the British Insulated and Helsby Cable Company, Ltd., Prescot—are sharing in the orders for overhead transmission lines and transformers, to the value of £440,000, placed by the Central Electricity Board in connection with the North-Eastern scheme. Leyton (Essex) Borough Council has accepted the tender of the English Electric Company, Ltd., Preston, for the supply of fifty electric double-decked tramcar bodies at a contract price of £89,375. The same authority has accepted the tender of the Metropolitan-Vickers Electrical Company, Ltd., Manchester—£2537—for fifty sets of magnetic track and wheel brake equipments. Southport Corporation has placed an order for fourteen motor omnibuses, at a cost of £22,890, with the Vulcan Motor and Engineering Company, Ltd., Crossens, Southport. Application for permission to borrow that sum has been sanctioned by the Ministry of Health.

### Ironworks to be Restarted.

With the financial help of a number of employees of the firm, Mr. John Fletcher has purchased the business and premises of Samuel Walker and Sons, Ltd., Eagle Ironworks, Radcliffe. It was recently announced that bad trade had necessitated closing down and that the plant would be dismantled. The works had been in operation for about 60 years, and until recently employed nearly 200 people. Contributors to the purchase price and the necessary working capital include many employees, who are either contributing varying lump sums or are prepared to contribute weekly from their wages. Mr. Fletcher has expressed the hope during the last few days that the works would be in a position to resume full-time operations by the beginning of next year.

### North or South?

Whether the North or South will suffer an industrial loss is a problem which may have to be solved shortly. A Bolton firm of constructional engineers, John Booth and Sons, Ltd., which carries on the manufacture of fireproof doors and shutters at its Marsden Road Works, Bolton, has taken over a similar business in Bermondsey. A representative of the firm states that an important point for it will be to find out whether it will pay to continue to manufacture at both works, the alternative being to discover which of the works—the northern or the southern—is the more practicable economically. It is possible that a definite decision may be delayed for about twelve months.

### University Appointment.

Mr. H. Threlfall, Lecturer in Mechanical Engineering at Manchester University, has just been appointed a member of the Board of the Faculty of Technology.

### Non-ferrous Metals.

Spelter has lost further ground slightly on balance for the week, but in all other sections the non-ferrous metals market has been steady to firm, without, however, very much in the way of business, apart from speculative transactions, going through. Copper is somewhat dearer compared with last report, and a certain amount of forward buying, largely on speculative account, has been reported. Demand for refined descriptions from the cable-making and other industries has been by no means active. Tin prices are on pretty much the same level as a week ago, notwithstanding the fact that the month-end statistics disclose an increase in visible supplies of the metal of rather more than 1200 tons. There has, however, been a moderate amount of buying interest shown, and it is believed that the undertone in this section of the market is somewhat steadier. Compared with a week ago, lead is a shilling or two cheaper, with the demand on a limited scale. Sellers, however, are not inclined to offer too freely. In the case of spelter, the undertone has been relatively weak again, although recovering a little in the early days of the present week. Sales in this section are still on quiet lines.

### Iron and Steel.

There has been little appreciable change in the position of the iron and steel trades in this area. So far as steel is concerned, users continue to be poorly engaged, except in rare instances, but apart from this there is an almost universal disinclination to buy ahead until their own prospects improve very materially or steel prices fall, as they are confidently expected to do sooner or later. The unfortunate factor about the price situation is that until there is some certainty about the matter prospects of improvement in the bulk trade are likely to be postponed in a good many branches of the consuming industries, for it is believed that in some instances work is being held up in consequence. Offers of joists are on the basis of £8 10s. per ton, sections £8 7s. 6d., large bars, 3in. and upwards, £9 7s. 6d., general plates £8 17s. 6d., acid and basic quality boiler plates about £9 7s. 6d., and small re-rolled bars at £7 7s. 6d. Without as a general rule committing themselves too far ahead, foundry iron buyers on this market, as reported here a week ago, are displaying more interest, and somewhat bigger deliveries are going into consumption. There has been little quotable change in prices in this section of the market.

BARROW-IN-FURNESS.

### Hematite.

The slight improvement which was noticeable in the pig iron market a few weeks ago has not been maintained. There is very little life about it at the present time, and there are no signs of improvement visible. It would not be so bad if the steel departments had some orders to deal with, for then some of the iron produced would go to the converters instead of, as at present, going into stock. Everywhere stocks are rising, and it is not a comforting sign to see the "warrants" increasing week by week. There is some overseas trade, but it does not amount to much. America is a buyer, but only on a small scale, for trade in the States does not merit a large tonnage of hematite pig iron. The Backbarrow furnace is working again on high-grade iron, after being closed for a few weeks. This furnace at one time had the distinction of being the only charcoal furnace in the country, but it has now gone over to ordinary fuel and is turning out a high-grade iron which finds a good market in the Midlands. There is nothing to say about the iron ore trade, which is dull in all respects. The steel trade is in a similar condition, with almost complete idleness in the rail departments, though there is some business for hoops. The general outlook for this district is not over bright as regards unemployment, and it is feared that the total will increase week by week. Shipbuilding is only moderately engaged, and as ships are completed there are no fresh orders to fill the empty berths.

## SHEFFIELD.

*(From our own Correspondent.)*

### The "Heavy" Depression.

THERE is, unfortunately, no improvement to record in the condition of the heavy steel trades of this district. The number of open-hearth furnaces at work is unchanged, and does not represent more than a third of capacity. Orders continue to be individually small, and the booking of forward business is so poor that it is impossible to say that even the present restricted operations can be maintained for more than a week or two ahead. On the heavy manufacturing side the production of hollow rolled drums is providing a useful amount of work for the forging departments. The specifications from the railway companies are considerably below the level of twelve months ago, and the shops devoted to axles, tires, and springs are consequently very short of work. There is a better outlook for buffers, however. Large orders were reported only a few weeks ago, and more have since been received. The call for shipbuilding steel, generally, is poor, but John Brown and Co., at their Atlas Works, are fairly well fixed in this department. They are to build the great new 60,000-ton Cunard liner at Clydebank, the contract for which was officially signed and sealed on Monday last. Large quantities of forgings for this vessel are being made at Brown's Sheffield works, where they will provide employment for twelve months. Some of the work has been delivered already.

### Special Departments.

In the manufacturing department, which provides supplies for the automobile builders, conditions are only moderate. While large quantities of steel and tools are being called for in connection with the construction of commercial vehicles, the requirements for touring cars are poor. There is a good deal of activity in stainless, non-corrodible, and heat-resisting steels, about eight or nine varieties of which are now available for different engineering purposes. In this connection, a matter of interest is that a stainless steel casket has been made to hold the names of all the Sheffield men who fell in the war, and this is to be placed in the Memorial Shelter erected in the Sheffield-Serre Memorial Park at Serre les Puisieux, on the Somme battlefield. The casket, which is about 16in. in length by 6in. in height and breadth, has been given by Sir Robert Hadfield and the directors of Hadfields, Ltd., and a protective cabinet of teak is the gift of the directors of Walker and Hall, Ltd. The trade in cold-rolled steel and strip is much less active than it was a year ago, and suffers seriously from foreign competition.

### Employment and Organisation.

The general state of industry in Sheffield can be judged from the fact that the numbers on the unemployment register are 20,000 more than a year ago. The continuous rise ceased, however, a fortnight ago. There are frequent dismissals of staff employees in consequence of reorganisations on the administrative side. Owing to derating and improved organisation of works and offices, production costs are now considerably lower than they were last year. In some cases, advantage is being taken of the savings to carry out improvements and developments which are calculated to be beneficial when normal trade conditions are restored.

### Saws and Hacksaws.

A fair trade is being maintained in saws of various kinds, especially hacksaws. In the larger kinds demand is chiefly from the home market, but a moderate amount of export business continues to be done. A remark of the Chancellor of the Exchequer has attracted some attention in Sheffield during the past week. He stated that a friend of his, who went into a Norwegian shop to buy a British saw, was told by the shopkeeper that, although he had been trading in that place for fifty years he had never seen a British traveller. Inquiries in Sheffield, however, show that several saw-making firms trade with Norway, and one of them states that Sheffield does fairly well with circular saws in that market. Considerable progress is reported in the local trade in hacksaws. Arthur Balfour and Co., Ltd., have purchased the engineering works of Dewhursts' Engineering Company, Tinsley Park-road, and intend to convert it into a factory for the manufacture of hacksaws, as Balfours' business in that branch has outgrown its present output capacity. James Neill and Co. (Sheffield), Ltd., are building a large new factory adjoining their present works, which is to be devoted to the production of hacksaws. It is only a year or two since another local firm, Hacksaws, Ltd., of Owlerton, carried out extensions to its works, which doubled its capacity.

### Cutlery and Plate.

Although the special Christmas trade in cutlery and plate has now fallen off considerably, there is still a steady flow of small late orders from merchants and shopkeepers. The number of well-employed firms, however, forms only a small minority. Great slackness is to be found in many cases, especially where the firms are dependent to any considerable extent on the Australian market. There are complaints of intense price-cutting in stainless table knives. A knife of a new pattern for table use has just been brought out, and is being marketed by several firms. Its characteristics are a shorter blade and a longer handle than those of the familiar type of knife. In the table size the blade is only 3¼in. long, and the handle 4¼in. It is pointed out that nothing is lost by shortening the blade, as only a small portion of it comes into contact with the food, while the longer handle is more comfortable to the diner. Knives of this form are popular in America. There are some good contracts on hand for the equipment of ships and restaurants, and the building of the great new Cunarder promises work for this department, as the great vessel will require about 300,000 pieces of silverware and 60,000 pieces of cutlery. Sheffield is still trying to persuade the Chancellor of the Exchequer to alter his decision with regard to allowing the Safeguarding Duty on cutlery to lapse, although he stated a fortnight ago that he would not reconsider the matter, and that the policy of the Government was unaltered. The Sheffield branch of the National Union of Manufacturers, at its annual meeting on Monday, unanimously carried a resolution expressing the gravest apprehension at the withdrawal of the duty, and urgently appealing to the Government to postpone any decision on the matter for a further twelve months, in order to allow a full investigation into the position.

### Success of Heavy-oil Omnibus.

The tramways department of Sheffield Corporation, which last March placed in service a heavy-oil-engined omnibus, is so pleased with the result that a second vehicle of the same type has now been put on the road. The department is satisfied that a great saving, estimated at £300 per year per omnibus, can be effected by replacing the ordinary petrol-driven vehicle with one of the heavy-oil type.

### Electrical Matters.

Some interesting evidence as to the comparative cost of supplying electricity by means of overhead and underground cables was given last week at a Ministry of Transport inquiry with regard to the proposal of the South Yorkshire Power Company to give a service to the Hope Valley, in the Peak District, near Sheffield. There was objection to overhead cables by the Derbyshire County Council and others. The County Council represented that, besides detracting from the amenities of the countryside, which it was determined to preserve, overhead power lines constituted a danger to pedestrians and traffic. For the Power Company it was stated that the cost of underground cables was about £1300 per mile, while overhead cables cost only half that amount. At present it was estimated that electricity would cost 4½d. per unit for all supplies. Underground cables would mean an additional 1½d. per unit. The cost of street lighting would be considerably cheaper with overhead wires. It has since been announced that a compromise has been arrived at, under which the cables will be placed underground at Bamford and Castleton, while the overhead cables at Hope will be placed behind the property on the main road. The Electric Supply Department of Sheffield Corporation has accepted the tender of A. Reyrolle and Co., Ltd., amounting to £1275 16s., for the supply of sub-station switchgear. The Newcastle Electric Supply Company, Ltd., has placed further large orders in connection with its new Dunston-on-Tyne "B" power station. Among the firms concerned is Joseph Booth Brothers, Ltd., of Leeds, which is to supply two overhead electric travelling cranes, one capable of lifting 120 tons and the other 25 tons, at a price of about £5500.

### Trade Mission's Return.

The members of the Sheffield Trade Mission to South America, headed by Mr. A. K. Wilson, ex-Master Cutler, who left this country on August 1st are expected to arrive back at Liverpool on December 19th. The Sheffield Chamber of Commerce is to hold a banquet in their honour on January 15th, when the guests will include Mr. W. Graham, President of the Board of Trade, and Mr. G. M. Gillett, Secretary of the Department of Overseas Trade.

## NORTH OF ENGLAND.

*(From our own Correspondent.)*

### New Electrical Contracts.

CONTRACTS amounting to a little short of £500,000 have just been placed by the Central Electricity Board in connection with the North-East Coast grid scheme. Of this sum, about £53,000 will go to A. Reyrolle and Co., of Hebburn, for switchgear for Dunston power station. This order follows close upon the £130,000 order placed with the firm through the Newcastle Electric Supply Company. Of the remainder of the half-million, £440,000 has been given out in orders for the overhead lines and steel towers, and, although none of these has gone to North-East firms, a large proportion of the amount will be spent in local sub-contracts and in local labour for the erection of the overhead lines and sub-stations.

### Cleveland Iron Trade.

There is very little change in the Cleveland pig iron trade. Consumers are still disinclined to commit themselves beyond the end of the year, and most transactions are for December delivery. It is, nevertheless, a hopeful sign that continental prices reflect a continuous advance. The latter are still well below Cleveland quotations, but the margin is being narrowed, and consumers who have been using foreign material are now inclined to consider British offers. The restricted output continues to fall rather short of current needs, and the statistical position is gradually being strengthened by a slow, but steady, reduction of stocks. Merchants have very little Cleveland iron to offer, and ironmasters hold to their fixed minimum prices for home consumption, but are understood to be prepared to make substantial concessions to secure trade with firms in Scotland. No. 1 Cleveland foundry iron is 66s., No. 3 G.M.B. 63s. 6d., No. 4 foundry 62s. 6d., and No. 4 forge 62s.

### Lowest Exports for Four Years.

The recent collapse in foreign prices of iron and steel is reflected in a sharp decline in the exports from the Cleveland district during November. Latterly, European prices have shown some recovery, and it looks as though the weaker sellers have been weeded out. Thus, the outlook for the home industry seems to be somewhat less gloomy, but contracts made at low prices have to be implemented, and this fact has affected the November shipments from the Tees. The export figures for November are actually the lowest for any month since January, 1927, when the industry was just restarting after the prolonged paralysis caused by the coal strike. Pig iron shipments fell from 22,944 tons in October to 12,301 tons in November, the contraction being fairly equally divided between coastwise and foreign destinations. Manufactured iron and steel shipments fell in the same period from 40,724 tons to 35,117 tons, the decline being continuous since July last. Shipments to African ports fell by more than 50 per cent., and although Indian business decreased by less than 500 tons, the exports to that country were the smallest of the year. Imports of pig iron and semi-manufactured steel into the Tees during November totalled 11,313 tons, the lowest since February. In October, the imports reached 21,182 tons.

### Hematite Pig Iron.

A steady tone pervades the East Coast hematite pig iron trade. A moderate home business is passing, and both producers and merchants incline to the opinion that values are more likely to advance than otherwise. Quotations are not definitely fixed, but recognised market rates are in the neighbourhood of the equivalent of ordinary qualities at 71s. No. 1 quality is at 71s. 6d.

### Ironmaking Materials.

Foreign ore is difficult to dispose of, consumers having considerable stocks and being well bought. The nominal price of best Rubio is 16s. c.i.f. Tees. Blast-furnace coke keeps plentiful, but sellers are unwilling to reduce quotations. For early delivery of good average qualities 17s. is still asked.

### Manufactured Iron and Steel.

In the manufactured iron and steel trade new business develops slowly, but substantial tonnage output continues in one or two departments. There has been a little more activity in semi-finished steel, but foreign competition is severe. As regards finished steel also, foreign materials are quoted pounds per ton below prices named for the products of this area. Departments producing constructional materials and railway requisites are fairly well employed, but branches making steel commodities for the shipyards are urgently in need of work. The reduction of the home minimum price of galvanised corrugated sheets to £11 5s. has brought in rather a spate of orders, and black sheets are in somewhat better request at £8 12s. 6d. Other steel prices may be reviewed at the end of the year, but for the present they are unchanged.

### The Coal Trade.

Work is proceeding normally throughout all the Northumberland areas, and in the Durham area only two mines are idle because of disagreements concerning the working of the Coal Mines Act. The Northumberland steam coal trade is fairly well situated, as owners generally report well filled loading turns, and there is no large surplus of any grade available. Sellers, consequently, hold very steadily, and are inclined to press for some appreciation in values owing to December being a short working month. Best Northumberland steams are quoted at 13s. 6d., with seconds at 12s. 6d. Small steam coal is plentiful, but is quoted steadily. There is also a better outlook for Durham steams at 14s. 9d. for best grades. Prime gas coals are in strong demand, special qualities being scarce at fully 16s. minimum, while best kinds hold to 15s. Durham coking unscreened are slightly firmer at 12s. 6d. to 13s. Secondary gas coals are also steadier at 12s. 6d. to 13s. There is a brisk demand for bunker coals, and prices are maintained. The gas coke trade is quiet, but, owing to scarcity of stocks, prices hold firm at 21s. 6d. Patent oven coke is offered freely at 17s. to 17s. 6d., but buyers hold off. Beehive and superior foundry coke is steady at 24s. to 28s.

### Coal Proceeds and Costs.

Accountancy ascertainments regarding proceeds and costs in the coal industry in Northumberland and Durham for October indicate considerable improvement in the economic position. Results in each county are almost identical, and show that output was at a steadier level and that costs were a little lower. In Northumberland prices have been stabilised all the year, but in Durham they have varied a little, and latterly they have been moving in an upward direction. These price fluctuations may disappear to some extent soon, as minimum prices have already been fixed for Northumberland under the new Coal Mines Act, and it is probable that the Durham prices will be fixed by the end of this week. As a result of the trading in October, Durham in the present month will be able to pay 46·97 per cent. on the basis, as compared with 39·28 per cent. in November—an increase of 7·69 per cent. The minimum percentage in Durham is 65, and, therefore, the owners have to make up in terms of the county agreement 18·03 per cent.

## SCOTLAND.

*(From our own Correspondent.)*

### Shipbuilding.

APART from the settlement of the preliminary details and the commencement of work in connection with the construction of the new Cunarder at Clydebank, there is no sign of any development calculated to increase work in the Clyde shipyards. In short, the work in progress is rapidly diminishing, and fresh orders are of little account. During the month of November nine vessels of 21,479 tons aggregate were launched from Clyde yards, which is the lowest return for any one month this year. Three vessels almost accounted for the November output, and these are as follows:—The "British Bride," oil tanker, 7180 tons, for the British Tanker Company, Ltd., London; the "Soudan," cargo steamer, 6800 tons, for the P. and O. Steam Navigation Company; and the "Arica," cargo steamer, 4200 tons, for Compania Chileria de Navegacion Interoceania, Valparaiso, Chile. During November only four contracts have been reported, one being for a 500-ton paddle steamer for the L.N.E.R. Company, and another

an order for a composite vessel for the Corporation of Trinity House for lightship service. The aggregate Clyde output for 1929 amounted to 565,798 tons, and Clyde shipbuilders would require to launch over 77,000 tons of shipping during December to equal last year's total.

**Steel and Iron.**

A feature has just been provided by an advance in prices on the Continent, which is due, it is said, to considerable buying by Eastern markets. The movement is encouraging, though it may not denote a general increase in buying. Meanwhile business here remains as dull as at any period since the depression set in, and idle time is all too common. It has been quite a usual occurrence in recent years to note a feeling of greater confidence at this season of the year, and to-day it is again apparent. Operations at steel works are still carried on considerably below plant capacity, owing in a large measure to the dearth of orders for shipbuilding materials. After being closed for a week, Stewarts and Lloyds' Mossend works have been reopened, but the Calderbank works of James Dunlop and Co.—now merged in the new company to be known as Colvilles Ltd.—have been closed down. Steel sheets are poorly specified, being adversely affected by Belgian competition and reduced demands from overseas, especially India, and the prohibition of imports into Australia. The new minimum price for galvanised sheets is £11 5s. per ton for 24 g. galvanised, f.o.b. Glasgow. Steel tubes, bar iron, and re-rolled steel bars are extremely dull. The last named is quoted £7 7s. 6d. home and £7 5s. per ton export. Business in pig iron is very subdued, and the same may be said of scrap. Pig iron quotations are unchanged, while cast iron machinery scrap is about 60s., and heavy steel scrap 50s. per ton.

**Coal.**

Business in the coal trade was dominated by the uncertainty with regard to future action on the employment question. Supplies of fuel became increasingly scarce for shipment before the end of the week, and latterly it was impossible to obtain even modest quantities unless at greatly enhanced prices, which practically prohibited transactions. Considerably larger quantities were taken by local gas and electricity concerns, and household depôts, and also by shippers catering for the London and Irish markets. Consequently, with the collieries retaining supplies for use against a stoppage of work, a shortage soon became apparent. Prices for shipment were purely nominal, while for household purposes advances of 1½d. to 3d. per cwt. were imposed at the week-end. Aggregate shipments amounted to 244,970 tons, against 239,576 tons in the preceding week and 300,361 tons in the same week last year. As it has turned out, the stoppage in Scotland was not universal, and it is expected that all the collieries in operation last week will have restarted work before the end of the present week.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

**The Coal Situation.**

EVENTS have moved very rapidly since I wrote a week ago. The view was then expressed that the probabilities were that there would be no stoppage of work in the coalfield this week, but before last week was out, it was quite impossible to be optimistic regarding the prospects, for the position was changing every day. It is now, of course, a matter of history that the miners' representatives decided to put their case respecting a new wages agreement before the National Industrial Board, that the South Wales coalowners declined to accept the invitation of that board to discuss the matter, as they were opposed to terms and conditions being dealt with by coalowners and miners' leaders from other districts, and that a suggestion was then made by the National Board that the parties concerned should use the machinery at their disposal to get together. The result was that the venue of discussions was again moved from London to Cardiff, and on Saturday there was a full attendance of delegates from the coalfield at a conference. It will thus be seen that the avoidance of a stoppage was only brought about by eleventh-hour negotiations, and all concerned in the export trade and the industry as a whole, were in a state of great anxiety right up to the last. What took place on the Saturday was that, despite the decision of the Miners' Federation of Great Britain putting a ban on the "spread-over" of working hours, an agreement was come to between the parties, involving the adoption of that arrangement. The coalowners, in order to make a temporary agreement possible, revised entirely the conditions of their original offer upon which work was to be possible in the coalfield on Monday. The delegate conference of South Wales miners accepted under protest the new offer of the coalowners, which stipulated for no variation in existing terms and conditions of payment during the month of December; the continuance of the present percentage payment of bonus turns and overtime for week-end work; that there should be forthwith a meeting of the Conciliation Board to settle conditions and terms of employment for a permanent "spread-over" of hours and in the event of failure to agree within fourteen days from December 1st, the matter to be referred to independent arbitration; collieries to be opened for work on day-to-day contracts and total hours to be worked not to exceed 90 in a fortnight. As a matter of fact, the hours to be temporarily worked are eight per day for eleven days per fortnight. The men will have the benefit of two hours a fortnight as compared with the time specified by the Act. The idea is to work eight hours one Saturday and to close the pits the other Saturday, for which the men will be paid. It should be pointed out that the Conference of miners' delegates, although agreeing to the terms of the coalowners for temporary working by an overwhelming majority, did not accept the condition that in the event of the parties failing to agree on terms for a a permanent agreement, the matter should be referred to independent arbitration. They are determined that in this event the matter shall go to the National Industrial Board. It only remains to remark that the men in South Wales have loyally stood by the decision of the leaders, and are at work, though there was slight trouble in the Trehavod district, where extremists did their utmost to keep the men at the Lewis-Merthyr collieries from going to work, and on Monday 600 men at Tarreni Colliery, Godre'rgraig, suspended operations as a protest against the decision of the Conference. The coalowners' representatives on the Conciliation Board, on Tuesday, met the men's representatives to open negotiations for a permanent wages agreement, but, so far as can be ascertained, not much was done, and the meeting stands adjourned until after the national delegate conference of miners in London on Thursday.

**Market Effect.**

There has been a more comfortable feeling prevailing in coal market circles this week as a consequence of the respite of a month, but it would be a mistake to say that traders are now free from anxiety regarding the outlook. Everyone is, of course, hoping for the best; but so often the minority has dictated to the majority in coalfield affairs in this district that it is well not to be too optimistic, and it must be admitted that some very difficult problems have to be solved before complete agreement is come to regarding terms of work. There is so much room for division of opinion and there is so little time in which to negotiate. Business has, of course, been adversely affected by the uncertainty which has existed for so long, but collieries are now working better. As a matter of fact, owing to delayed tonnage coming along more freely over the week-end, the position at the docks was that shipment activity was greater than for some time. It is true that just over 20 tips were idle at the various docks on Monday of this week, but, at the same time, there were 15 steamers waiting to berth. Chartering operations are improving, and it would be no surprise if the conditions from now up to the Christmas holidays showed briskness. Exporters will be desirous of getting their cargoes off earlier in the month, and there is also the extra incentive of making sure about deliveries in case there is trouble at the end of the month. Hopes are entertained that now that the air is cleared to a large extent, business for delivery ahead will be resumed. The inquiry that figures largely in the minds of most of the leading firms is that from the Egyptian State Railways for 155,000 metric tons of locomotive coals for delivery at Alexandria over the first four months of next year. Tenders have to be deposited by the 16th inst.

**Coalfield Audit.**

The ascertainment of the joint auditors of the finances of the South Wales coal industry makes a better show than expected for the three months of August, September and October. Eighty-five per cent. of the proceeds allocated to the workmen amounted to £3,990,415, or sufficient for the payment of 11·59 per cent. on the 1915 standard rates. As the present minimum percentage is 28, the miners' wages will continue unaltered for the next three months, provided there is a continuance of the existing terms of agreement. The total wages paid per manshift averaged 93s. 6·23d.

**Tin-plate Works.**

Two tin-plate works made a restart on Monday last, these being the Villiers Tin-plate Works, Briton Ferry, which have been idle for the past six weeks, and the Ferry Tin-plate Works, also at Briton Ferry. The latter had been idle for a fortnight.

**Tin-plate Pool.**

Although tin-plate trade conditions are quiet, there is evidence of a slightly better inquiry. Meetings of manufacturers were held at Swansea on Tuesday last, when it was officially announced that the most important firms previously outside the pooling scheme had agreed to fall into line, and that the prospects were that arrangements would be made whereby the two or three firms who are now outside would join the pool. It was agreed to examine immediately a scheme submitted for the control of sales.

**Ebbw Vale Prospects.**

According to the chairman of the Ebbw Vale Central Relief Committee, the reply of Sir John Beynon, chairman of the Ebbw Vale Steel, Iron and Coal Company, Ltd., to the deputation which recently met him regarding resumption of operations at the works, was: "There are no immediate prospects of a revival in the iron and steel industry such as would justify the restarting of the Ebbw Vale Iron and Steel Works." Efforts, however, are to be made by trade union leaders to obtain another interview with Sir John Beynon in order to discuss the question in all its bearings.

**Current Business.**

So far as can be seen, there is not much new business on the steam coal market, though there is a tendency for depôt owners to replenish their stations and for other receivers to come along for small cargoes for fairly early shipment. The tone of some sections is steadier, though it must be admitted that stocks of most qualities are fairly heavy. Large coals are, for the most part, on the minima, while small coals, which were firmer last week on account of the action of coalowners in stocking up supplies for their boilers in case there was a stoppage of work in the coalfield, are easier as supplies of smalls are now released for shipment. Sized coals are still very steady, but coke and patent fuel remain without material change. Pitwood has improved substantially, as sellers are now asking 28s. to 28s. 6d. for prompt delivery.

## B.E.S.A. SPECIFICATIONS.

### PORCELAIN INSULATORS FOR POWER LINES.

THE British Engineering Standards Association has recently issued an important revision of the British Standard Specification for Porcelain Insulators. The 1922 edition was limited in scope to insulators suitable for use on lines of voltages up to 150 kV, whereas the new specification is applicable for voltages up to 350 kV. The most important feature of the new specification, apart from its extended scope, is the table of test-voltages, which differs in several respects from the table in the old specification. The insulators are identified by arbitrary "rating numbers," for each of which a series of tests has been laid down. The table does not attempt to establish a rigid relationship between the test-voltage and the working voltage, since, in practice, this relationship is a variable factor, largely influenced by climatic conditions. In a separate table, however, is given a recommendation regarding the circuit voltages for which the lower-voltage sizes of insulators are suitable, since experience has shown that for these particular sizes the insulators may, normally, be satisfactorily assigned to certain definite circuit voltages. For all the higher voltages there is no definite instruction with regard to the relation between the size of insulator and the circuit voltage, but a formula, internationally agreed upon by the International Electrotechnical Commission, is given as an indication of the maximum circuit voltage to be associated under any conditions with a particular size of insulator. A further feature of the specification is that the order of the tests has been arranged in such a way that each test may have a material bearing upon the behaviour of an insulator in subsequent tests. Interesting additions are an appendix on impulse voltage tests and an appendix on the co-relation of electric strengths of insulators on the line and on apparatus connected thereto.

Copies of this revised specification (No. 137–1930) may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, S.W. 1, price 2s. 2d. post free.

## LAUNCHES AND TRIAL TRIPS.

STEGG, single-screw tank motor ship; built by Sir W. G. Armstrong, Whitworth and Co. (Shipbuilders), Ltd., to the order of Skibsaktieselskapet "Cleantank," of Oslo; dimensions, 408ft. by 54ft. 9in. Engines, oil, Armstrong-Sulzer type; constructed by the builders; trial trip, October 15th.

MAVIS, steamship; built by Workman, Clark (1928), Ltd., to the order of General Steam Navigation Company, Ltd.; dimensions, 225ft. by 35ft. by 21ft. 6in. Engines, triple-expansion; constructed by the builders; trial trip, October 28th.

GANGES, single-screw steamer; built by Harland and Wolff, Ltd., to the order of James Nourse, Ltd.; dimensions, 423ft. 6in. by 55ft. 9in. by 31ft. 4in.; to carry cargo and emigrants. Engines, triple-expansion, pressure 230 lb. per square inch; constructed by D. and W. Henderson and Co., Ltd.; trial trip, October 29th.

## PERSONAL AND BUSINESS ANNOUNCEMENTS

MR. C. NORMAN FLETCHER has been appointed the managing director of Edward G. Herbert, Ltd., of Levenshulme, Manchester.

LIEUT.-COLONEL T. S. MORRISEY, D.S.O., vice-president and general manager, Combustion Engineering Corporation, Ltd., Canada, an associate of International Combustion, Ltd., has arrived in this country and is staying at Flemings Hotel, Clarges-street, Piccadilly, London, W. 1. Colonel Morrisey is severing his connection with the Combustion Engineering Corporation, Ltd., at the end of this year in order to join the board of United Engineers and Constructors (Canada), Ltd., and during his visit to this country desires to meet executives of any British industries contemplating the establishment of factories or plants in Canadian territory.

## CONTRACTS.

RUSTON AND HORNSBY, Ltd., of Lincoln, have received a repeat order for an additional six-cylinder vertical airless-injection oil engine, 450 B.H.P., for the Jerusalem Power Station.

MERRYWEATHER AND SONS, Ltd., of Greenwich, have received an order to provide and fix a fire-resisting curtain for the stage of the Shakespeare Memorial Theatre now being built at Stratford-on-Avon.

THE ENGLISH ELECTRIC COMPANY, Ltd., has received an order for twelve pairs of equal-wheel tramcar trucks for Liverpool. The trucks are to be complete with motors, and a special feature of the trucks is to be that the motor frame will be utilised as the basis of the truck, the motor being mounted between the wheel axles and at right angles to them. The order includes control equipments of the foot-operated, electro-pneumatic type for the twelve cars. The total value of the contract is about £25,000.

INSTITUTION OF NAVAL ARCHITECTS' SCHOLARSHIPS.—The following scholarships will be offered for competition in 1931:—Naval architecture: Elgar Scholarship (130 per annum for three years), and the Vickers-Armstrong Scholarship (£150 per annum for three years). Marine engineering: Parsons Scholarship (£150 per annum for three years), and the Denny Scholarship £75 per annum for four years). The Denny Scholarship is open to boys under 19 years of age from public or secondary schools who have not yet begun their apprenticeship, and is tenable at Glasgow University. The remaining scholarships are open to apprentices between the ages of 18 and 23, and are tenable at the Royal Naval College, Greenwich, Glasgow University, Armstrong College, Liverpool University, and the City and Guilds (Engineering) College. Full particulars may be obtained from the Secretary of the Institution of Naval Architects, 2, Adam-street, Adelphi, London, W.C. 2.

ROYAL INSTITUTION.—At a general meeting of the members of the Royal Institution, held on Monday afternoon, December 1st, Sir Robert Robertson, Treasurer and Vice-President, in the chair, Lord Eustace Percy was unanimously elected President of the Institution in succession to the late Duke of Northumberland. The thanks of the members were returned to Major C. E. S. Phillips, Secretary, for his gift of a water colour of the Royal Institution by T. Hosmer Shepherd; to Mr. R. W. Paul and Mr. R. S. Whipple, for their present of an auxiliary projection apparatus for the Lecture Theatre; to Mr. S. G. Brown, for a handphone installation and equipment for the Lecture Theatre; to Mrs. Tyndall, for a silver-plated inkstand, formerly the property of Michael Faraday; and to Mr. L. Rome Guthrie, for a Japanese paper for the Ambulatory and for the restoration of early plans of the Institution. Mr. Angus Blue, Mr. P. Dunsheath, Mrs. Frisell, Miss Pomeroy and Professor A. M. Tyndall were elected members.

# Current Prices for Metals and Fuels.

## IRON ORE.

| | |
|---|---|
| N.W. COAST— | |
| (1) Native | 17/9 to 20/6 |
| (1) Spanish | 20/6 to 21/– |
| N.E. COAST— | |
| Native | 18/– to 21/– |
| Foreign (c.i.f.) | 16/– |

## PIG IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| (2) SCOTLAND— | | |
| Hematite | 3 17 0 | — |
| No. 1 Foundry | 3 19 0 | — |
| No. 3 Foundry | 3 16 6 | — |
| N.E. COAST— | | |
| Hematite Mixed Nos. | 3 11 0 | 3 11 0 |
| No. 1 | 3 11 6 | 3 11 6 |
| Cleveland— | | |
| No. 1 | 3 6 0 | 3 6 0 |
| Siliceous Iron | 3 6 0 | 3 6 0 |
| No. 3 G.M.B. | 3 3 6 | 3 3 6 |
| No. 4 Foundry | 3 2 6 | 3 2 6 |
| No. 4 Forge | 3 2 0 | 3 2 0 |
| Mottled | 3 1 6 | 3 1 6 |
| White | 3 1 6 | 3 1 6 |
| MIDLANDS— | | |
| (c) Staffs.— | (*Delivered to Station.*) | |
| All-mine (Cold Blast) | — | — |
| North Staffs. Forge | 3 6 0 | — |
| ,, ,, Foundry | 3 11 0 | — |
| (c) Northampton— | | |
| Foundry No. 3 | 3 7 6 | — |
| Forge | 3 2 6 | — |
| Derbyshire— | | |
| No. 3 Foundry | 3 11 0 | — |
| Forge | 3 6 0 | — |
| (3) Lincolnshire— | | |
| No. 3 Foundry | — | — |
| No. 4 Forge | — | — |
| Basic | — | — |
| (4) N.W. COAST— | | |
| N. Lancs. and Cum.— | | |
| Hematite Mixed Nos. | 4 3 6 (*a*) / 4 5 6 (*b*) / 4 10 6 (*c*) | — |

## MANUFACTURED IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| SCOTLAND— | | |
| Crown Bars | 10 5 0 | 9 15 0 |
| Best | — | — |
| N.E. COAST— | | |
| Iron Rivets | 11 10 0 | — |
| Common Bars | 10 15 0 | — |
| Best Bars | 11 5 0 | — |
| Double Best Bars | 11 15 0 | — |
| Treble Best Bars | 12 5 0 | — |
| LANCS.— | | |
| Crown Bars | 10 5 0 | — |
| Second Quality Bars | 8 15 0 | — |
| Hoops | 13 0 0 | — |
| S. YORKS.— | | |
| Crown Bars | 10 5 0 | — |
| Best Bars | 11 0 0 | — |
| Hoops | 12 0 0 | — |
| MIDLANDS— | | |
| Crown Bars | 10 0 0 to 10 7 6 | — |
| Marked Bars (Staffs.) | 12 10 0 | — |
| Nut and Bolt Bars | 9 0 0 to 9 5 0 | — |
| Gas Tube Strip | 10 17 6 | — |

## STEEL. (*d*)

| | (6) Home. £ s. d. | (7) Export. £ s. d. |
|---|---|---|
| (5) SCOTLAND— | | |
| Boiler Plates (Marine) | 10 10 0 | 10 10 0 |
| ,, ,, (Land) | 10 0 0 | 10 0 0 |
| Ship Plates, ½in. and up | 8 15 0 | 7 15 0 |
| Sections | 8 7 6 | 7 7 6 |
| Steel Sheets, ¼in. | 8 15 0 | 8 15 0 |
| Sheets (Gal. Cor. 24 B.G.) | 11 7 6 | 11 5 0 |

## STEEL (*continued*).

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| N.E. COAST— | | |
| Ship Plates | 8 15 0 | 7 15 0 |
| Angles | 8 7 6 | 7 7 6 |
| Boiler Plates (Marine) | 10 10 0 | — |
| ,, ,, (Land) | 10 0 0 | — |
| Joists | 8 10 0 | 7 7 6 |
| Heavy Rails | 8 10 0 | — |
| Fish-plates | 12 0 0 | — |
| Channels | 10 5 0 | £9 to £9 5s. |
| Hard Billets | 6 2 6 | — |
| Soft Billets | 6 17 6 | — |
| N.W. COAST— | | |
| BARROW— | | |
| Heavy Rails | 8 10 0 | — |
| Light Rails | 8 15 0 to 9 0 0 | — |
| Billets | 6 15 0 to 9 10 0 | — |
| MANCHESTER— | | |
| Bars (Round) | 9 7 6 | — |
| ,, (Small Round) | 7 7 6 | — |
| Hoops (Baling) | 10 0 0 | 9 15 0 |
| ,, (Soft Steel) | 9 0 0 | 8 15 0 |
| Plates | 8 17 6 to 9 2 6 | — |
| ,, (Lancs. Boiler) | 9 7 6 | — |
| SHEFFIELD— | | |
| Siemens Acid Billets | 9 10 0 (basis) | — |
| Hard Basic | 9 2 6 and 9 12 6 | — |
| Intermediate Basic | 7 12 6 and 8 2 6 | — |
| Soft Basic | 6 10 0 | — |
| Hoops | 10 5 0 | — |
| Soft Wire Rods | 8 0 0 | — |
| MIDLANDS— | | |
| Small Rolled Bars | 7 7 6 to 8 5 0 | — |
| Billets and Sheet Bars | 5 12 6 to 6 10 0 | — |
| Galv. Sheets, f.o.b. L'pool | 11 5 0 | — |
| (2) Staffordshire Hoops | 10 0 0 | — |
| Angles | 8 7 6 | — |
| Joists | 8 10 0 | — |
| Tees | 9 7 6 | — |
| Bridge and Tank Plates | 8 17 6 | — |
| Boiler Plates | 9 7 6 to 9 10 0 | — |

## NON-FERROUS METALS.

| | |
|---|---|
| SWANSEA— | |
| Tin-plates, I.C., 20 by 14 f.o.b. | 16/– to 16/3 |
| Block Tin (Cash) | 114 5 0 |
| ,, (three months) | 115 10 0 |
| Copper (cash) | 50 7 6 |
| ,, (three months) | 50 7 6 |
| Spanish Lead (cash) | 15 17 6 |
| ,, ,, (three months) | 16 0 0 |
| Spelter (cash) | 14 8 9 |
| ,, (three months) | 14 8 9 |
| MANCHESTER— | |
| Copper, Best Selected Ingots | 52 10 0 |
| ,, Electrolytic | 55 10 0 |
| ,, Strong Sheets | 84 0 0 |
| ,, Tubes (Basis Price), lb. | 0 1 0 |
| Brass Tubes (Basis Price), lb. | 0 0 10½ |
| ,, Condenser, lb. | 0 1 0½ |
| Lead English | 17 10 0 |
| ,, Foreign | 15 2 6 |
| Spelter | 14 12 6 |
| Aluminium (per ton—raw ingot) | £95 |

## FERRO ALLOYS.

| | Per Ton. | Per Unit. |
|---|---|---|
| Tungsten Metal Powder | 2/6 per lb. | |
| Ferro Tungsten | 2/3 per lb. | |
| Ferro Chrome, 4 p.c. to 6 p.c. carbon | £23 5 6 | 7/– |
| ,, ,, 6 p.c. to 8 p.c. | £22 10 0 | 7/– |
| ,, ,, 8 p.c. to 10 p.c. | £22 0 0 | 7/– |
| ,, ,, Specially Refined | | |
| ,, ,, Max. 2 p.c. carbon | £33 0 0 | 10/– |
| ,, ,, ,, 1 p.c. carbon | £38 0 0 | 13/– |
| ,, ,, ,, 0·70 p.c. carbon | £41 0 0 | 14/– |
| ,, ,, ,, carbon free | 11d. per lb. | |
| Metallic Chromium | 2/7 per lb. | |
| Ferro Manganese (per ton) | £11 15 0 for home | |
| ,, ,, ,, | £11 5 0 for export | |
| ,, Silicon, 45 p.c. to 50 p.c. | £11 10 0 scale 5/– per unit | |
| ,, ,, 75 p.c. | £18 0 0 scale 7/– per unit | |
| ,, Vanadium | 12/9 per lb. | |
| ,, Molybdenum | 4/2 per lb. | |
| ,, Titanium (carbon free) | 11d. per lb. | |
| Nickel (per ton) | £170 to £175 | |
| Ferro Cobalt | 9/6 per lb. | |

## FUELS.

### SCOTLAND.

(*No Quotations this week.*)

| | Export. |
|---|---|
| LANARKSHIRE— | |
| (f.o.b. Glasgow)—Steam | — |
| ,, ,, Ell | — |
| ,, ,, Splint | — |
| ,, ,, Trebles | — |
| ,, ,, Doubles | — |
| ,, ,, Singles | — |
| AYRSHIRE— | |
| (f.o.b. Ports)—Steam | — |
| ,, ,, Jewel | — |
| ,, ,, Trebles | — |
| FIFESHIRE— | |
| (f.o.b. Methil or Burntisland)—Steam | — |
| Screened Navigation | — |
| Trebles | — |
| Doubles | — |
| Singles | — |
| LOTHIANS— | |
| (f.o.b. Leith)—Best Steam | — |
| Secondary Steam | — |
| Trebles | — |
| Doubles | — |
| Singles | — |

### ENGLAND.

| | |
|---|---|
| (8) N.W. COAST— | |
| Steams | 20/6 to 21/– |
| Household | 32/6 to 53/6 |
| Coke | 21/– to 22/– |
| NORTHUMBERLAND— | |
| Best Steams | 13/6 |
| Second Steams | 12/– |
| Steam Smalls | 10/– to 10/6 |
| Unscreened | 12/6 |
| Household | 25/– to 37/– |
| DURHAM— | |
| Best Gas | 14/9 to 15/– |
| Second | 12/9 to 13/– |
| Household | 25/– to 37/– |
| Foundry Coke | 24/– to 26/– |
| SHEFFIELD— | Inland. |
| Best Hand-picked Branch | 25/6 to 27/– |
| Derbyshire Best Bright House | 20/– to 22/6 |
| Best House Coal | 19/6 to 20/6 |
| Screened House Coal | 17/6 to 19/– |
| ,, ,, Nuts | 14/6 to 16/6 |
| Yorkshire Hards | 14/– to 15/6 |
| Derbyshire Hards | 14/– to 15/6 |
| Rough Slacks | 8/6 to 9/– |
| Nutty Slacks | 6/6 to 7/– |
| Smalls | 3/– to 5/– |
| Blast-furnace Coke (Inland) | 11/– on rail at ovens |
| Furnace and Foundry Coke (Export), f.o.b. | 16/6 to 17/– |

### (9) SOUTH WALES.

| | |
|---|---|
| CARDIFF— | |
| Steam Coals : | |
| Best Smokeless Large | 20/– |
| Second Smokeless Large | 18/9 to 19/9 |
| Best Dry Large | 18/6 to 18/9 |
| Ordinary Dry Large | 17/6 to 18/– |
| Best Black Vein Large | 18/3 to 18/6 |
| Western Valley Large | 18/– to 18/3 |
| Best Eastern Valley Large | 17/7½ to 17/9 |
| Ordinary Eastern Valley Large | 17/6 to 17/7½ |
| Best Steam Smalls | 13/3 to 13/9 |
| Ordinary Smalls | 11/6 to 12/9 |
| Washed Nuts | 17/6 to 21/6 |
| No. 3 Rhondda Large | 20/– to 20/6 |
| ,, ,, Smalls | 15/6 to 16/– |
| No. 2 ,, Large | 17/– to 17/3 |
| ,, ,, Through | 16/– to 16/6 |
| ,, ,, Smalls | 14/– to 14/3 |
| Foundry Coke (Export) | 27/6 to 35/– |
| Furnace Coke (Export) | 17/6 to 20/– |
| Patent Fuel | 21/6 |
| Pitwood (ex ship) | 27/– to 28/– |
| SWANSEA— | |
| Anthracite Coals : | |
| Best Big Vein Large | 35/– to 37/6 |
| Seconds | 27/– to 31/6 |
| Red Vein | 23/6 to 27/– |
| Machine-made Cobbles | 41/6 to 45/– |
| Nuts | 40/– to 46/– |
| Beans | 24/6 to 28/– |
| Peas | 20/3 to 21/6 |
| Breaker Duff | 9/9 to 10/3 |
| Rubbly Culm | 9/– to 9/6 |
| Steam Coals : | |
| Large | 19/6 to 21/6 |
| Seconds | 18/– to 19/6 |
| Smalls | 12/– to 13/– |
| Cargo Through | 15/6 to 16/– |

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate : Joists (minimum), 12/6 ; Ordinary Ship, Bridge, and Tank Plates and Sections, 10/– if home consumers confine purchases from associated British Steel Makers. (*e*) Delivered Black Country Stations.

# French Engineering Notes.

(*From our own Correspondent in Paris.*)

### Coal.

IT is hardly necessary to insist upon the attention which continental coalowners are paying to the course of events in the British colliery industry. Any cessation of work at the British collieries would relieve them of heavy accumulations of stocks, amounting to about 10 million tons in the Ruhr and more than 2,500,000 tons in Belgium, while in France stocks at the pits are increasing. British miners are fighting against enormous odds when the Ruhr coalowners are able to reduce prices 1·5 mark per ton following upon a lowering of wages. That applies to the home market, and it is probable that a still greater reduction would be allowed for export. In France coalowners were in a particularly favourable position until recently, but they are now feeling the effects of the smaller consumption of industrial fuels and also of the mild weather, which restricts the demand for domestic sorts. There is plenty of coal to make up for any cessation of supplies in Great Britain, if arrangements are made for handling it.

### Flood Protection.

The memory of the Paris floods of 1910 is still vivid enough to arouse alarm when the Seine shows a tendency to rise to a dangerously high level. A vast scheme of protective works was then prepared, and although twenty years have elapsed much remains to be done before the danger is removed, at least so far as Paris is concerned. What has already been accomplished in the way of raising embankments and suppressing some of the obstacles to the flow of water through Paris, notably La Monnaie barrage, and in dredging the Seine, besides carrying out works above and below the city, has ensured a fair measure of protection, and during the menacing rise of the Seine last week the temporary works consisted in closing the openings of embankments with concrete and installing pumps for dealing with infiltrations of water. Little more can be done in Paris beyond reconstructing the Alma Bridge with less obstructive arches, but it is hoped that the overflow canal from the Marne to the Seine at Saint-Denis on the north of Paris will have some good effect, while more important still are the works carried out below the city, where fixed barrages are being replaced by others that can be opened in times of flood. The reservoirs in the upper valley of the Seine may have some temporary effect in reducing the volume of water, but it is hardly likely to do much to prevent floods in view of the small difference of the Seine level.

### African Railway Construction.

The authority granted to the Government of Equatorial Africa to issue a loan for the completion of the railway between the Congo and the Atlantic Coast will allow of new constructive methods being adopted in place of those which proved so disastrous to the undertaking in its early stage. At the outset the authorities had not taken into account the physical limitations of native labour for such work, and when operations were started simultaneously at both ends—at Brazzaville and Pointe-Noire—the hecatomb of native carriers in unhealthy territories traversed by the railway compelled the French Government to intervene. It was then seen that the only way to complete the undertaking was to lay down a light railway for the transport of material and stores and to employ machinery with as little native labour as possible. Operations were nevertheless continued and some progress has been made, but the railway could not be pushed forward rapidly until the Colonial Government was able to procure additional funds, partly for the purchase of the necessary machinery and plant. The railway passes through a mountain range and over a vast marshy territory, and the nature of the country involves the construction of numerous tunnels, cuttings, viaducts and bridges. The Colonial Government is already preparing to distribute orders for ten steam navvies and fifty-four rail motor vehicles, together with a large quantity of rock drilling and concrete making plant and other material. The port of Pointe-Noire is at present unable to receive ships of ordinary draught, and the programme of works includes the building of a mole to prevent the silting up of the port, the dredging of a channel and the construction of wharves and warehouses and an oil depot.

### The Trans-Saharan Railway.

The Government is believed to have delayed the introduction into the Chamber of Deputies of the Bill for the construction of the Trans-Saharan Railway because it fears to impose further financial burdens on the public at a time when so much money is to be spent upon other public works. There are, of course, technical problems which the partisans of the railway declare are of small moment in these days of engineering progress. In their opinion, the State participation will impose no burden on the public, for the reason that there is every prospect of the railway beginning to pay its way within five years of its construction. There is, nevertheless, much competent opinion which believes that the Trans-Saharan Railway will always absorb money. Perhaps undue importance is attached to the strategical value of the line and to its forming the main link of a system which will eventually constitute a direct route from Algeria and Morocco to the Cape by way of Central Africa and the Belgian Congo Railway.

### Shipbuilders' Union.

When the Conseil National Economique was entrusted with the task of investigating the ways and means of bringing back prosperity to the shipbuilding industry it made certain financial proposals which were dependent upon shipbuilders doing something themselves, by concentration and rationalisation, to effect economies and bring down costs. All the shipyards have now been grouped in a Consortium National de Constructeurs Navals. The president is Monsieur Emmanual Rousseau, Conseiller d'Etat. Some progress has already been made in the way of standardising ships and shipbuilding material.

# British Patent Specifications.

*When an invention is communicated from abroad the name and address of the communicator are printed in italics.*

*When an abridgment is not illustrated the Specification is without drawings.*

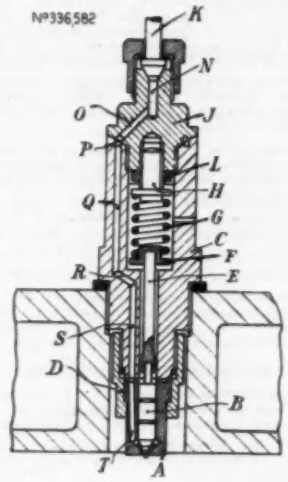
*Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.*

*The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.*

## INTERNAL COMBUSTION ENGINES.

336,582. July 9th, 1929.—FUEL INJECTION VALVES FOR INTERNAL COMBUSTION ENGINES, Robert Bosch Aktiengesellschaft, of 4, Militärstrasse, Stuttgart, Germany.

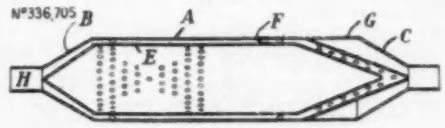
This specification describes a spring-loaded fuel injection valve for internal combustion engines. A jet member A receiving the jet needle B is held against the lower end of a housing C by means of a screw cap D. One end of a pressure bar or spindle E bears against the end of the jet needle nearest the housing, whilst the other end carries a spring plate F forming an abutment for a spring G. The second abutment for the spring is




formed by a screw H screwed into a nipple J, and to which an injection pipe K coming from an injection pump is connected. The screw H carries a lock-nut L, and can only be moved after screwing out the nipple J. The tension of the closing spring cannot therefore be altered during running. The fuel entering the nipple J at N is led through an inclined duct O and an annular groove P in the conical tightly-sealed seating between the nipple and the holder into a duct Q in the latter. It then passes through the duct R and S in the holder into the duct T in the jet member A.—*October 9th*, 1930.

336,705. August 10th, 1929.—EXHAUST SILENCERS, Horace Gastineau Hills, "Hill Top," Cheadle Hulme, Cheshire.

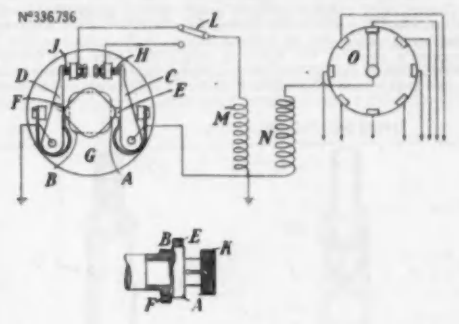
The silencer described in this specification comprises an outer casing A, preferably cylindrical, having conical ends B, C to receive the inlet and outlet connections. An inner vessel E is supported within the casing A by means which leave an annular space F between the two vessels. The ends of the inner vessel are preferably conical, as shown, and a portion of the vessel, preferably nearer to the exhaust gas inlet connection, is perforated to permit the gases to enter the vessel. The perforations do not extend over more than one-half of the length of the vessel, the remaining half, preferably at the gas outlet end of the silencer, being without perforations. Between the end of the vessel E and the conical end C of the casing, there is a perforated cone G. The cross sectional area of the annular space between




the casing A and vessel E, should not be less than the cross sectional area of the exhaust gas inlet branch H, whilst the total area of the perforations in the cone G should be less than the cross sectional area of the branch H. The annular space may be tapered and gradually decrease in width towards the gas outlet end of the silencer. The gases enter the silencer and pass into the annular space F, where they become cooled and reduced in volume, but at the moment of maximum exhaust gas pressure, gas enters the vessel E, so raising the pressure therein, such gas returning to the annular space in the interval between two succeeding exhaust valve openings. The vessel E, therefore, acts as a pressure compensator, or equaliser, and it is found that, owing to its equalising action in conjunction with the annular cooling space F, the exhaust gases leave the silencer in a steady stream practically free from noise and without imposing any back pressure upon the engine.—*October 23rd*, 1930.

336,736. September 3rd, 1929.—IGNITION APPARATUS FOR INTERNAL COMBUSTION ENGINES, the British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C. 2, and Ernest George Parrott, "Cottage," Balsall Common, near Coventry.

According to this invention, the ignition timing is changed by making use of two alternative contact breakers which are actuated by separate cams and selectively switching the insulated end of the primary winding of the magneto, or its equivalent, to the contact breaker giving the timing required. A and B are two cams, B being keyed to the magneto-driven shaft in the usual manner, and A being adjustably secured to the shaft. C and D are two contact breaking rocking levers, which are respectively engaged by the cams at the heel pieces E and F of the levers. The two levers are pivotally mounted on the common fixed base G and spring-biassed to make electrical contact at the points H and J respectively. As shown, the adjustable cam A fits over the reduced end of the shaft and is held against the cam B by a nut K. The two contiguous ends of the cams are provided with very fine serrations and may have graduation markings on their edges. By means of the change-over switch L, the magneto primary winding M is connected to either of the two contact breaker rocking levers. N indicates the magneto secondary winding, the insulated end of which con-

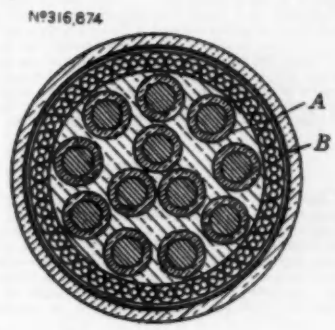



nects to the distributor O and thence to the sparking plugs in the usual manner. It will be seen that by operation of the change-over switch the timing given by either of the two contact breakers can be selectively employed for the ignition.—*October 23rd*, 1930.

## TELEGRAPHS AND TELEPHONES.

316,874. July 26th, 1929.—TRUNK CABLES WITH BALANCING CONDENSERS, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

According to this invention, supplementary wires are inserted in a submarine cable in such manner that the flexibility of the cable is not appreciably affected. These additional wires may be stranded in common with the main wires, or may be arranged as a closed layer of wire over the actual cable core for the whole of the length of the cable, or over short stretches thereof. They have a certain capacity and may, therefore, be used as balancing

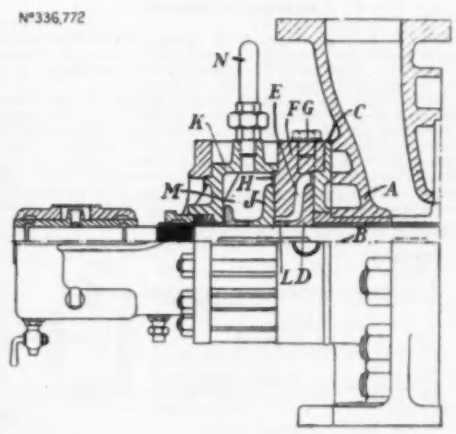



condensers to reduce cross talk. A is the normal core of the submarine cable, which, for example, may consist of 12 fours. Around this normal core and over the whole length there is a layer—B—of condenser wires, for example, double wires. The separate condenser wires are cut off at different lengths, so that the separate pieces between themselves have different capacities. In this way, by the connection of two main wires with two or more condenser wire parts combined, it is claimed to be possible to obtain a very exact balancing between the main wires.—*October 23rd*, 1930.

## PUMPING AND BLOWING MACHINERY.

336,772. October 1st, 1929.—DEVICES FOR BALANCING END THRUST IN CENTRIFUGAL PUMPS, the Harland Engineering Company, Ltd., and Frank Greaves Warburton, both of 72–74, Victoria-street, Westminster, London, S.W.

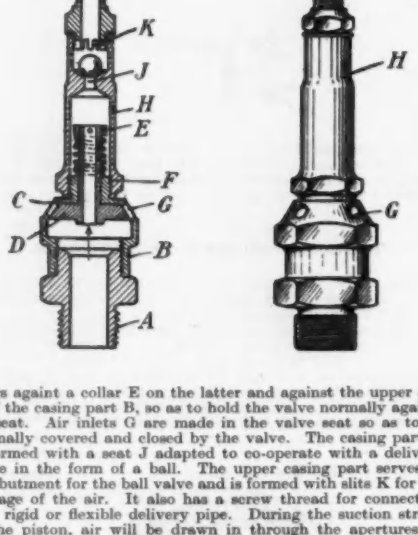
An object of this invention is to provide a means which shall ensure sufficient spacing of the revolving balancing arrangement from the stationary member with a minimum of leakage. The pump casing A carrying the rotor shaft B is provided with a face plate C, which co-operates with a balance disc D carried by the rotor shaft. The disc D is arranged in a chamber E bounded by a member F secured against the outer




portion of the plate C. The wall of the chamber E may be provided with an inspection hole G for checking the leakage clearance between the disc D and the plate C. The outer face H of the member F forms a face plate which co-operates with a second balance disc J carried by the rotor shaft. The disc J is arranged in a chamber M bounded by a member K secured against the outer portion of the face H of the member F. Leakage water passes between the plate C and the disc D into the chamber E, through the passage L to the disc J, and thence between the disc J and the face H into the chamber M. From this chamber the leakage water is discharged through the pipe N.—*October 23rd*, 1930.

336,796. October 17th, 1929.—AIR-PUMP VALVE ATTACHMENTS FOR INTERNAL COMBUSTION ENGINES, Alwin Richter, of 73, Bayersche Strasse, Leipzig, C. 3, Germany.

This invention relates to a valve attachment of the kind adapted to replace one of the sparking plugs of an internal combustion engine and to enable the latter to act as an air pump for inflating tires or for spraying oil The device comprises a tubular valve casing, which is composed of detachable parts, all screwed together. The part A has a screw thread, whereby the entire casing can be applied to one of the cylinders of the engine in place of the sparking plug. The part B is formed with a conical valve seat C for a downwardly-opening mushroom valve D provided with a hollow stem. A coil spring on the stem

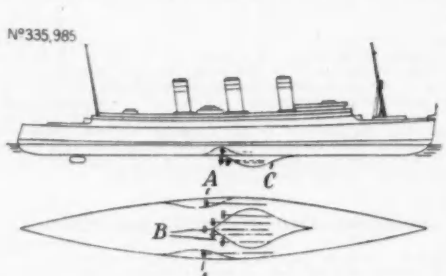



bears against a collar E on the latter and against the upper end F of the casing part B, so as to hold the valve normally against its seat. Air inlets G are made in the valve seat so as to be normally covered and closed by the valve. The casing part H is formed with a seat J adapted to co-operate with a delivery valve in the form of a ball. The upper casing part serves as an abutment for the ball valve and is formed with slits K for the passage of the air. It also has a screw thread for connection to a rigid or flexible delivery pipe. During the suction stroke of the piston, air will be drawn in through the apertures G, the ball valve being closed. During the return stroke of the piston, the apertures G will be closed by the valve D, and the air will be delivered to the outlet.—*October 23rd*, 1930.

## SHIPS AND BOATS.

335,985. July 5th, 1929.—PROPELLER SYSTEMS, J. de Meo, 39, Coventry-street, London, W. 1.

The inventor proposes to set the screw propellers of vessels amidships, so that the pitching of the ship will not affect their submergence, and vibration of the machinery will, consequently, be minimised when steaming in a seaway. The inventor has, in the past, suggested that this *desideratum* might be attained by arranging two side propellers as at A A in recesses in the

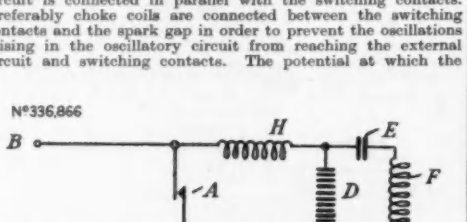



bilges. He now suggests the addition of further propellers under the bottom at B B. The shafts of these propellers would emerge from the after end of the excrescence C beneath the hull, and the lines of this excrescence would be faired off into those of the hull proper. Several modifications of the same broad principle are described in the specification.—*October 6th*, 1930.

## MISCELLANEOUS.

336,866. December 11th, 1929.—DEVICES FOR PREVENTING SPARKING AT SWITCHING CONTACTS, PARTICULARLY HIGH-TENSION CONTACTS, C. Lorenz Aktiengesellschaft, of 1, Lorenzweg, Berlin-Tempelhof, Germany.

According to this invention an arrangement for preventing sparking at switching contacts, particularly high-tension contacts, is provided, wherein a spark gap in an oscillatory circuit is connected in parallel with the switching contacts. Preferably choke coils are connected between the switching contacts and the spark gap in order to prevent the oscillations arising in the oscillatory circuit from reaching the external circuit and switching contacts. The potential at which the




spark gap breaks down must be slightly greater than the potential difference at the switching contacts, while the switch is open, in order to prevent a discharge taking place across the gap. A is a switch provided for the purpose of completing a circuit connected to the terminals B and C. A spark-extinguishing gap D, connected in the oscillatory circuit formed by the condenser E and an inductance F, is connected in parallel with the switching contacts. The oscillatory circuit may contain a damping resistance G. Preferably choke coils H and J are connected between the oscillatory circuit and the switching contacts to prevent the oscillations in the circuit E, F, G reaching the external circuit connected to the terminals C and B. When the external circuit is broken at the switch A, the excess potential brought about by the inductance of the circuit causes a discharge to pass across the spark gap D. This discharge excites oscillations in the circuit E, F, G, whereby the energy is dissipated in this circuit. In this way the formation of arcs at the switching contacts A is completely prevented.—*October 23rd*, 1930.

# Forthcoming Engagements.

***Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.***

### TO-DAY.

INSTITUTION OF CHEMICAL ENGINEERS.—In the Rooms of the Chemical Society, Burlington House, Piccadilly, W. 1. Conference on "The Utilisation of Trade Wastes." "The Problem of Tannery Waste," by Mr. D. Jordan Lloyd; "The Use of Wood Waste for Heating and Generation of Power," by Mr. Oswald Wans. Discussion. 10.30 a.m. Papers: "The Utilisation of Waste Rubber," by Mr. E. B. Busenburg; "The Recovery of Metal from Waste Materials," by Mr. J. W. Hinchley. Discussion. 2.30 p.m.

INSTITUTION OF LOCOMOTIVE ENGINEERS: MANCHESTER CENTRE.—In the Building of the Manchester Literary and Philosophical Society, 36, George-street, Manchester. Mr. J. N. Gresham will deliver an address, which will be followed by a paper "Fire-box Control," by Mr. A. L. H. Spencer. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. Extra general meeting. "Machinery and Methods of Manufacture of Sheet Glass," by Professor W. E. S. Turner. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Informal meeting. "Oil Burning for Domestic Central Heating," by Mr. R. L. Mayston. Slides. 7.30 p.m.

PHYSICAL SOCIETY.—At the Imperial College of Science, Imperial Institute-road, South Kensington, S.W. 7. Meeting at 5 p.m. Editing Committee meeting, 3.30 p.m. Council meeting, 4 p.m.

### TO-DAY AND SATURDAY, DECEMBER 6TH.

NORTHAMPTON POLYTECHNIC INSTITUTE.—St. John-street, London, E.C. 1. Annual prize distribution and students' conversazione. 7 p.m. The conversazione for members and students will be continued on Saturday. 6.30 p.m.

### SATURDAY, DECEMBER 6TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—At the College of Technology, Sackville-street, Manchester. "Foundries—and Foundries," by Mr. S. H. Russell. 4 p.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Meeting of the Yorkshire District, to be held at Mansion House, Doncaster. 2 p.m.

### MONDAY, DECEMBER 8TH.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.—Goldsmiths' Hall, London, E.C. 2. Imperial College dinner. 7 p.m. for 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Queen's Hotel, Birmingham. "Machine Tools from the Users' Point of View," by Mr. H. C. Armitage. 7 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, W.C. 2. Cantor Lecture, "Modern Domestic Scientific Appliances, Lecture III.," by Professor C. R. Darling. 8 p.m.

### MONDAY TO FRIDAY, DECEMBER 8TH TO 12TH.

SMITHFIELD CLUB SHOW, 1930.—Agricultural Hall, Islington, N. Annual Show. 9 a.m. to 9 p.m. daily.

### TUESDAY, DECEMBER 9TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH, BURNLEY SECTION.—At the Municipal Technical College, Ormerod-road, Burnley. "Survey in Making of Light Castings," by Mr. F. Harris. 7.15 p.m.

INSTITUTE OF METALS: NORTH-EAST COAST LOCAL SECTION.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Properties of Coke," by Professor H. V. A. Briscoe. 7.30 p.m.

INSTITUTE OF METALS: SWANSEA LOCAL SECTION.—At University College, Singleton Park, Swansea. Lecture and demonstration on "Copper Welding," by Messrs. W. Andrews and H. Martin. 6.15 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The King's Head Hotel, Coventry. "Light Alloy Piston Development," by Mr. E. V. Pannell. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: SCOTTISH CENTRE.—In the Engineers' Rooms, 39, Elmbank-crescent, Glasgow, C. 2. "The Cooling of Electrical Machines," by Mr. D. B. Hoseason. 7.30 p.m.

SHEFFIELD METALLURGICAL ASSOCIATION.—198, West-street, Sheffield. "Machining from a Machinist's Point of View," by Mr. Walter Locke. 7.30 p.m.

### WEDNESDAY, DECEMBER 10TH.

DIESEL ENGINE USERS ASSOCIATION.—Joint meeting with the Institute of Fuel at the Chemical Society's Rooms, Burlington House, Piccadilly. "High-power Gas and Diesel Engines for Electrical Generation," by Mr. M. Gercke. 6 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Metropole Hotel, King-street, Leeds. "Trends in the Transmission," by Dr. H. E. Merritt. 7.15 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, Westminster, S.W. 1. Informal meeting. Discussion, "Atmospheric Pollution Due to Combustion of Fuel, and Methods of its Prevention," by Dr. J. S. Owens. 6 p.m.

INSTITUTION OF ENGINEERING INSPECTION.—At the Rooms of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "Power Station Efficiency," by Mr. Percy E. Rycroft. Illustrated. 5.30 p.m.

INSTITUTION OF ENGINEERS-IN-CHARGE.—St. Bride Institute, Bride-lane, Fleet-street, E.C. 4. "Oil Fuel Heating," by Mr. G. Urquart Morgan. 7.30 p.m.

### THURSDAY, DECEMBER 11TH.

CHEMICAL ENGINEERING GROUP.—Joint Meeting with Bristol Section. In the Chemical Department of the University, Woodland-road, Bristol. "Modern Water Treatment," by Mr. S. Stevens. 6.30 p.m. Informal dinner, 8.30 p.m.

INSTITUTE OF METALS: LONDON LOCAL SECTION.—Joint meeting with the London Branch of the Institute of British Foundrymen, in the Meeting Room of the Chemical Society, Burlington House, W. 1. "Magnesium Alloy Castings," by Mr. E. Player. 8 p.m.

INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—In the Chamber of Commerce, New-street, Birmingham. "Plating," by Mr. E. J. Dobbs. 7 p.m.

INSTITUTION OF WELDING ENGINEERS.—The Institution of Mechanical Engineers, Storey's-gate, St. James's Park, London, S.W. 1. "The Fabrication of Plant in Acid-resisting Steels," by Mr. C. C. Hall. The paper will be illustrated by a film and lantern slides and will be followed by a discussion. 7.45 p.m.

OPTICAL SOCIETY.—At the Imperial College of Science and Technology, Imperial Institute-road, South Kensington, S.W. 7. "New Knowledge on Old Telescopes," by Mr. T. H. Court and Mr. Moritz von Rohr; "On Interpolating Refractive Indices," by Mrs. E. Gifford; "On the Determination of the Transmission Factors of Coloured Step Lenses," by Mr. H. Buckley. 7.30 p.m.

ROYAL AERONAUTICAL SOCIETY.—16, John-street, Adelphi, W.C. 2. "The Origin and Development of Heavy Oil Aero-engines," by Mr. D. R. Pye. 6.30 p.m.

### FRIDAY, DECEMBER 12TH.

DIESEL ENGINE USERS ASSOCIATION.—At Caxton Hall, Westminster. "Waste Heat Recovery from Internal Combustion Engines, with Particular Reference to Marine Oil Engines," by Major W. Gregson. 3.30 p.m.

ILLUMINATING ENGINEERING SOCIETY.—In the Lecture Theatre of Holophane, Ltd., Elverton-street, Vincent-square, Westminster, S.W. 1. "Glasses for Use with Invisible (Ultra-violet and Infra-red) Rays," illustrated by demonstrations, by Dr. S. English. 6.30 p.m. Prior to this meeting a special visit to the Chiswick works of the London General Omnibus Company, Ltd., for the purpose of inspecting the lighting arrangements, has been arranged. 4 p.m.

INSTITUTE OF FUEL.—Technical College, Green-lane, Derby. East Midlands Section meeting. "Some Factors Influencing the Design of a Combustion Chamber for Pulverised Fuel," by Mr. T. F. Hurley. 7.30 p.m.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—In the Non-ferrous Section of the Applied Science Department, the University, St. George's-square, Sheffield. "Studies in the Electro-deposition of Silver: Throwing Power: The Behaviour of Silver Anodes, with Special Reference to Blackening and its Prevention," by Mr. R. N. D. Barklie and Mr. A. E. Nicol. 7.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. "X-rays in Engineering Practice," by Dr. V. E. Pullin. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—At the Royal Society of Arts, John-street, Adelphi, W.C. 2. Presentation of awards by Sir Ernest Moir and induction of new President, Colonel Sir Henry George Lyons, F.R.S. Presidential address, "Technical Museums and their Value to Engineers." 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—In the Lecture Theatre of the Mining Institute, Newcastle-on-Tyne. "Refractories for Boiler Furnaces," by Mr. W. J. Rees. 6 p.m.

### FRIDAY AND SATURDAY, DECEMBER 12TH AND 13TH.

BOROUGH POLYTECHNIC.—Borough-road, S.E. 1. Exhibition of Students' Work. Friday, 6 p.m. to 9 p.m.; Saturday, 2.30 p.m. to 9.30 p.m.

### MONDAY, DECEMBER 15TH.

INSTITUTE OF FUEL.—Engineers' Club, Albert-square, Manchester. Joint meeting with the Institution of Electrical Engineers, the Institution of Mechanical Engineers, and the Association of Engineers. North-Western Section meeting. "Private Generation of Electricity *versus* the Grid," by Major E. Ivor David. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. Graduates' Section, London. Joint meeting with Students' Sections of the Institution of Civil Engineers and the Institution of Electrical Engineers. "Industrial Psychology," by Mr. W. H. Evans. 6.45 p.m.

### TUESDAY, DECEMBER 16TH.

INSTITUTION OF ELECTRICAL ENGINEERS: SCOTTISH CENTRE. At the North British Station Hotel, Edinburgh. "Modern Developments of the Metal-cylinder Mercury-Arc Rectifier," by Mr. G. Henderson. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS: YORKSHIRE BRANCH.—Alteration of programme, preliminary announcement. In order to facilitate the visit of the President to the Branch, it has been arranged that the date of the Chairman's address at Leeds be brought forward from Thursday, December 18th, to Tuesday, December 16th.

### WEDNESDAY, DECEMBER 17TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Engineering and Scientific Club, Queen-street, Wolverhampton. "Machine Tools from the Users' Point of View," by Mr. H. C. Armitage. 7.30 p.m.

INSTITUTION OF LOCOMOTIVE ENGINEERS (LONDON).—Denison House, 296, Vauxhall Bridge-road, Westminster, S.W. 1. "Possibilities of Condensing on Locomotives," by Mr. H. I. Andrews. 6 p.m.

### FRIDAY, DECEMBER 19TH.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Informal meeting. "Well Drill Blasting," by Mr. W. Cullen. 7.30 p.m.

### MONDAY, DECEMBER 22ND.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Institution of Engineers and Shipbuilders, 39, Elmbank-crescent, Glasgow. "Trends in the Transmission," by Dr. H. E. Merritt. 7.30 p.m.

### THURSDAY, DECEMBER 25TH.

CHRISTMAS DAY.

### 1931.

### FRIDAY, JANUARY 2ND.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. Extra general meeting. "An Experimental Investigation into Induction Conditions, Distribution, and Turbulence in Petrol Engines," by Mr. S. J. Davies. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Informal meeting. "Weighing Machinery," by Mr. W. A. Benton. Illustrated by slides and exhibits. 7.30 p.m.

### THURSDAY, JANUARY 8TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Merchant Venturers' Technical College, Unity-street, Bristol. "Light Alloy Piston Development," by Mr. E. V. Pannell. 7 p.m.

### SATURDAY, JANUARY 10TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—At the Grand Hotel, Manchester. Annual dinner. 6.30 p.m.

### WEDNESDAY, FEBRUARY 18TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Engineers' Club, Albert-square, Manchester. "Light Alloy Piston Development," by Mr. E. V. Pannell. 7 p.m.